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FINAL ENVIRONMENTAL IMPACT STATEMENT

SHADY BEACH FIRE RECOVERY PROJECT

Willamette National Forest
Lane County, Oregon

June 2, 1989

Lead Agency:	USDA Forest Service
Responsible Official:	Michael A. Kerrick Forest Supervisor Willamette National Forest 211 E. 7th Street Eugene, Oregon 97440
For Further Information Contact:	Herb Wick District Ranger or Dave Maercklein Rigdon Ranger District 49098 Salmon Creek Road Oakridge, Oregon 97463 (503) 782-2283

ABSTRACT

This Final Environmental Impact Statement describes five alternatives for the recovery of fire effects and salvage of timber killed in the Shady Beach Fire of September 1988. This fire burned 9,163 acres within the Rigdon Ranger District between Beach Mountain and Slapjack Butte, immediately to the east of Hills Creek Reservoir.

Alternatives were developed to respond to the major issues identified during the planning process and the public comment period. **Alternative B,** would harvest all dead and damaged timber under the direction of the 1977 Willamette National Forest Land Management Plan and interim Regional and Forest direction. **Alternative C, Preferred Alternative,** would harvest all dead timber possible under the standards and guidelines presented in the Proposed Land and Resource Management Plan which will be finalized in 1989. **Alternative D,** would harvest only dead timber while providing for resource protection and enhancement. **Alternative E, No Action**, would not harvest any of the fire-killed timber and rehabilitation activities would only take place if there was a threat of immediate resource damage. **Alternative F,** harvesting timber would be subordinate to protecting and enhancing wildlife habitat, water quality, and soil resources.

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TABLE OF CONTENTS

SUMMARY PAGE

INTRODUCTION S-1

PURPOSE AND NEED S-2

ISSUES, CONCERNS, AND OPPORTUNITIES S-2

AFFECTED ENVIRONMENT S-3

ALTERNATIVES S-4
    ALTERNATIVE E - NO ACTION, ENVIRONMENTALLY PREFERABLE S-5
    ALTERNATIVE B S-5
    ALTERNATIVE C - SELECTED ALTERNATIVE S-6
    ALTERNATIVE D S-6
    ALTERNATIVE F - ENVIRONMENTALLY PREFERABLE S-6

COMPARISON OF ALTERNATIVES S-7
    SOILS S-11
    WATER QUALITY/FISH HABITAT S-11
    TIMBER S-12
    WILDLIFE HABITAT/OLD-GROWTH S-12
    VISUALS/RECREATION S-13
    SOCIAL/ECONOMIC S-13

CHAPTER I - PURPOSE AND NEED PAGE

INTRODUCTION I-1

MANAGEMENT DIRECTION I-2

PURPOSE AND NEED I-3

OVERVIEW OF THE ANALYSIS AREA I-4

CHAPTER I - PURPOSE AND NEED

PAGE

- **ISSUES, CONCERNS, AND OPPORTUNITIES** I-6
  - INTRODUCTION I-6
  - ISSUE IDENTIFICATION I-6
    - **Discussion of Issues and Key Indicators** I-6
      - Soils I-6
      - Water Quality/Fish Habitat I-7
      - Timber I-7
      - Wildlife Habitat I-7
      - Visuals/Recreation I-8
      - Social/Economic I-8

- **FEIS ORGANIZATION** I-9

CHAPTER II - ALTERNATIVES, INCLUDING THE PROPOSED ACTION

PAGE

- **INTRODUCTION** II-1

- **ALTERNATIVE DEVELOPMENT PROCESS** II-2

- **DESCRIPTION OF THE ANALYSIS PROCESS** II-3

- **ALTERNATIVES CONSIDERED BUT NOT GIVEN DETAILED STUDY** II-4
  - NO CHANGE II-4
  - ALTERNATIVE A II-4

- **ALTERNATIVES CONSIDERED IN DETAIL** II-5
  - FEATURES COMMON TO ALL ALTERNATIVES II-5
  - FEATURES COMMON TO ALTERNATIVES B, C, D, AND F II-6
  - RESOURCE IMPACT MITIGATION AND ENHANCEMENT II-6
    - **Mitigations and Enhancements Common to Alternatives B, C, D, and F** II-7
    - **Mitigations and Enhancements Common to Alternatives C, D, and F** II-9
    - **Mitigations and Enhancements Common to Alternatives C and D** II-10
    - **Mitigations and Enhancements for Alternative B** II-10
    - **Mitigations and Enhancements for Alternative F** II-11
  - MONITORING II-11
    - **Monitoring Activities Common to Alternatives B, C, D, and F** II-11

CHAPTER II - ALTERNATIVES, INCLUDING THE PROPOSED ACTION

PAGE

ALTERNATIVE DESCRIPTIONS II-12
Alternative E - No Action, Environmentally Preferable II-12
Alternative B II-13
Water Quality/Fish Habitat II-13
Timber II-13
Wildlife Habitat II-13
Alternative C - Selected Alternative II-13
Water Quality/Fish Habitat II-14
Timber II-14
Wildlife Habitat II-14
Alternative D II-14
Water Quality/Fish Habitat II-14
Timber II-14
Wildlife Habitat II-15
Alternative F - Environmentally Preferable II-15
Soils II-15
Water Quality/Fish Habitat II-15
Timber II-15
Wildlife Habitat II-15

COMPARISON OF ALTERNATIVES II-17
SOILS II-21
WATER QUALITY/FISH HABITAT II-22
TIMBER II-23
WILDLIFE HABITAT II-27
VISUALS/RECREATION II-29
SOCIAL/ECONOMIC II-30

CHAPTER III - THE AFFECTED ENVIRONMENT

PAGE

INTRODUCTION III-1
LAND OWNERSHIP AND CONDITION III-2
PAST MANAGEMENT III-2

GEOLOGY AND SOILS III-3
GEOLOGY III-3
Recent Landslides III-3
SOILS III-5
Soil Productivity III-5
Fire Effects on Soil Productivity III-7
1. Changes in Water Repellency III-7
2. Changes in Soil Structure III-7
3. Removal of Vegetation, Duff, Litter, and Large Woody Material III-7
4. Reduction of Rooting Strength III-9
Soil-Erosion Potential III-9
Rehabilitation Accomplished III-10

CHAPTER III - THE AFFECTED ENVIRONMENT PAGE

WATER AND FISH III-11
WATER III-11
Precipitation III-13
Channel Morphology III-13
Water Quality III-13
Temperature III-14
Stream Flows and the Transitional Snow Zone III-17
Aggregate Recovery Percentage III-18
Sediment Movement III-19
Turbidity III-20
FISH III-20

AIR III-23

VEGETATION III-25
FOREST STAND STRUCTURE III-26
Old-Growth III-26
REFORESTATION III-27
DETERIORATION OF FIRE-KILLED TREES III-27
THREATENED, ENDANGERED, AND SENSITIVE PLANTS III-28

FIRE AND FUELS III-29
FIRE HISTORY III-29
FUEL LOADING III-29
Fuel Accumulation III-30
FIRE BEHAVIOR III-30

WILDLIFE III-32
BIG-GAME HABITAT III-32
BIRDS III-35
OLD-GROWTH HABITAT III-35
INTERIOR FOREST SPECIES HABITAT III-36
DEAD AND DEFECTIVE TREE HABITAT III-37
RIPARIAN-DEPENDENT SPECIES III-38
THREATENED, ENDANGERED, AND SENSITIVE SPECIES III-38

CULTURAL III-40

RECREATION III-41
DEVELOPED RECREATION SITES III-41
DISPERSED RECREATION III-41

VISUALS III-43

DEVELOPMENTS AND IMPROVEMENTS III-45

MINERALS AND ENERGY III-46

CHAPTER III - THE AFFECTED ENVIRONMENT PAGE

SOCIAL AND ECONOMIC III-47
HISTORY OF THE LOCAL COMMUNITY III-47
The Local Community III-48
CONTRIBUTIONS TO EMPLOYMENT III-50
CONTRIBUTIONS TO COUNTY FUNDING III-52
SHADY BEACH RECOVERY PROJECT COSTS III-54

CHAPTER IV - ENVIRONMENTAL CONSEQUENCES PAGE

INTRODUCTION IV-1

GEOLOGY AND SOILS IV-3
INTRODUCTION IV-3
Soil Productivity IV-3
Surface-Soil Erosion IV-4
Mass Wasting IV-5
EFFECTS COMMON TO ALL ALTERNATIVES IV-5
EFFECTS COMMON TO ALTERNATIVES B, C, D, AND F IV-5
ALTERNATIVE E - NO ACTION IV-6
Total Organic Material (TOM) IV-6
Surface-Soil Erosion IV-6
Mass Wasting IV-8
ALTERNATIVE B IV-8
Total Organic Material (TOM) IV-8
Surface-Soil Erosion IV-9
Mass Wasting IV-9
ALTERNATIVE C IV-10
Total Organic Material (TOM) IV-10
Surface-Soil Erosion IV-10
Mass Wasting IV-11
ALTERNATIVE D IV-11
Total Organic Material (TOM) IV-11
Surface-Soil Erosion IV-11
Mass Wasting IV-11
ALTERNATIVE F IV-12
Total Organic Material (TOM) IV-12
Surface-Soil Erosion IV-12
Mass Wasting IV-13

WATER AND FISH IV-14
WATER IV-14
FISH IV-14
Streamflow and Sediment IV-14
Temperature IV-15
Large Woody Debris IV-16

CHAPTER IV - ENVIRONMENTAL CONSEQUENCES PAGE

EFFECTS COMMON TO ALL ALTERNATIVES IV-17
  Temperature IV-17
  Streamflow Changes and ARP IV-17
  Sediment Movement and Turbidity IV-18
  Hills Creek Reservoir IV-20
  Large Woody Debris IV-20
EFFECTS COMMON TO ALTERNATIVES B, C, D, AND F IV-20
  Temperature IV-20
  Streamflow Changes and ARP IV-20
  Sediment Movement and Turbidity IV-21
ALTERNATIVE E - NO ACTION IV-21
  Temperature IV-21
  Streamflow Changes and ARP IV-22
  Sediment Movement and Turbidity IV-23
  Fish IV-25
    Large Woody Debris IV-25
ALTERNATIVE B IV-26
  Temperature IV-26
  Streamflow Changes and ARP IV-28
  Sediment Movement and Turbidity IV-28
  Fish IV-29
    Large Woody Debris IV-29
ALTERNATIVE C IV-30
  Temperature IV-30
  Streamflow Changes and ARP IV-31
  Sediment Movement and Turbidity IV-32
  Fish IV-33
    Large Woody Debris IV-33
ALTERNATIVE D IV-34
  Temperature IV-34
  Streamflow Changes and ARP IV-34
  Sediment Movement and Turbidity IV-35
  Fish IV-36
    Large Woody Debris IV-36
ALTERNATIVE F IV-37
  Temperature IV-37
  Streamflow Changes and ARP IV-37
  Sediment Movement and Turbidity IV-38
  Fish IV-39
    Large Woody Debris IV-39

AIR QUALITY IV-41
EFFECTS COMMON TO ALTERNATIVES B, C, D, AND F IV-41
ALTERNATIVE E - NO ACTION IV-42

CHAPTER IV - ENVIRONMENTAL CONSEQUENCES

	PAGE
VEGETATION	IV-43
FOREST STAND STRUCTURE	IV-43
Old-Growth	IV-43
REFORESTATION	IV-43
DETERIORATION OF FIRE-KILLED TIMBER	IV-44
EFFECTS COMMON TO ALL ALTERNATIVES	IV-46
EFFECTS COMMON TO ALTERNATIVES B, C, D, AND F	IV-46
ALTERNATIVE E - NO ACTION	IV-47
Old-Growth	IV-47
Theoretical Volume Loss	IV-47
Sensitive Plant Effects	IV-43
ALTERNATIVE B	IV-48
Regeneration Harvest Regime	IV-48
Old-Growth	IV-49
Theoretical Volume Loss	IV-49
Sensitive Plant Effects	IV-50
ALTERNATIVE C	IV-50
Regeneration Harvest Regime	IV-50
Old-Growth	IV-51
Theoretical Volume Loss	IV-51
Sensitive Plant Effects	IV-51
ALTERNATIVE D	IV-52
Regeneration Harvest Regime	IV-52
Old-Growth	IV-53
Theoretical Volume Loss	IV-53
Sensitive Plant Effects	IV-53
ALTERNATIVE F	IV-54
Regeneration Harvest Regime	IV-54
Old-Growth	IV-55
Theoretical Volume Loss	IV-55
Sensitive Plant Effects	IV-55
FIRE AND FUELS	IV-57
FIRE	IV-57
FUELS	IV-57
EFFECTS COMMON TO ALL ALTERNATIVES	IV-57
EFFECTS COMMON TO ALTERNATIVES B, C, D, AND F	IV-58
ALTERNATIVE E - NO ACTION	IV-59
Fuel Loading and Fire Behavior	IV-59
ALTERNATIVE B	IV-60
ALTERNATIVE C	IV-61
ALTERNATIVE D	IV-62
ALTERNATIVE F	IV-63

CHAPTER IV - ENVIRONMENTAL CONSEQUENCES PAGE

WILDLIFE IV-65
  INTRODUCTION IV-65
    Big-Game Habitat IV-65
    Old-Growth Habitat IV-67
    Interior Forest Species Habitat IV-67
    Dead and Defective Tree Habitat IV-68
    Riparian-Dependent Species IV-69
  EFFECTS COMMON TO ALL ALTERNATIVES IV-69
    Bird Habitat IV-69
    Dead and Defective Tree Habitat IV-69
    Riparian-Dependent Species IV-72
    Threatened, Endangered, and Sensitive Species IV-72
  ALTERNATIVE E - NO ACTION IV-73
    Big-Game Habitat IV-73
    Old-Growth Habitat IV-75
    Interior Forest Species Habitat IV-75
    Dead and Defective Tree Habitat IV-75
    Riparian-Dependent Species IV-75
    Threatened, Endangered, and Sensitive Species IV-75
  ALTERNATIVE B IV-75
    Big-Game Habitat IV-75
    Bird Habitat IV-77
    Old-Growth Habitat IV-77
    Interior Forest Species Habitat IV-77
    Dead and Defective Tree Habitat IV-78
    Riparian-Dependent Species IV-79
    Threatened, Endangered, and Sensitive Species IV-79
  ALTERNATIVE C IV-80
    Big-Game Habitat IV-80
    Bird Habitat IV-82
    Old-Growth Habitat IV-82
    Interior Forest Species Habitat IV-82
    Dead and Defective Tree Habitat IV-82
    Riparian-Dependent Species IV-82
    Threatened, Endangered, and Sensitive Species IV-83
  ALTERNATIVE D IV-83
    Big-Game Habitat IV-83
    Bird Habitat IV-85
    Old-Growth Habitat IV-85
    Interior Forest Species Habitat IV-85
    Dead and Defective Tree Habitat IV-86
    Riparian-Dependent Species IV-86
    Threatened, Endangered, and Sensitive Species IV-86

CHAPTER IV - ENVIRONMENTAL CONSEQUENCES PAGE

- ALTERNATIVE F IV-87
  - **Big-Game Habitat** IV-87
  - **Bird Habitat** IV-88
  - **Old-Growth Habitat** IV-88
  - **Interior Forest Species Habitat** IV-89
  - **Dead and Defective Tree Habitat** IV-89
  - **Riparian-Dependent Species** IV-89
  - **Threatened, Endangered, and Sensitive Species** IV-89

CULTURAL IV-90
- INTRODUCTION IV-90
- EFFECTS COMMON TO ALTERNATIVES B, C, AND F IV-90
- ALTERNATIVE E - NO ACTION IV-91
- ALTERNATIVE D IV-91

RECREATION IV-92
- INTRODUCTION IV-92
- EFFECTS COMMON TO ALL ALTERNATIVES IV-92
- EFFECTS COMMON TO ALTERNATIVES B, C, D, AND F IV-93
- ALTERNATIVE E - NO ACTION IV-93
- ALTERNATIVE B IV-94
- ALTERNATIVE C IV-94
- ALTERNATIVE D IV-94
- ALTERNATIVE F IV-94

VISUALS IV-95
- INTRODUCTION IV-95
- EFFECTS COMMON TO ALTERNATIVES B, C, D, AND F IV-95
  - **Percent Harvest Rate Per Decade and Opening Size** IV-95
  - **Logging Slash Disposal** IV-96
  - **Logging System and Harvest Area Design** IV-96
- ALTERNATIVE E - NO ACTION IV-97
- ALTERNATIVE B IV-97
- ALTERNATIVE C IV-98
- ALTERNATIVE D IV-98
- ALTERNATIVE F IV-98

DEVELOPMENTS AND IMPROVEMENTS IV-99
- EFFECTS COMMON TO ALL ALTERNATIVES IV-99
- EFFECTS COMMON TO ALTERNATIVES B, C, D, AND F IV-99
- EFFECTS COMMON TO ALTERNATIVES B AND C IV-99
- ALTERNATIVE E - NO ACTION IV-100
- ALTERNATIVE D IV-100
- ALTERNATIVE F IV-100

CHAPTER IV - ENVIRONMENTAL CONSEQUENCES PAGE

MINERALS AND ENERGY IV-101
MINERALS IV-101
EFFECTS COMMON TO ALTERNATIVES B, C, AND F IV-101
ALTERNATIVE E - NO ACTION IV-101
ENERGY IV-101
EFFECTS COMMON TO ALL ALTERNATIVES IV-101

SOCIAL AND ECONOMIC IV-102
INTRODUCTION IV-102
Assumptions IV-102
Stumpage Value IV-104
Mill Pond Value IV-104
Costs IV-104
Project Appraisal Estimates IV-105
EFFECTS COMMON TO ALL ALTERNATIVES IV-107
ALTERNATIVE E - NO ACTION IV-107
ALTERNATIVE B IV-108
ALTERNATIVE C IV-108
ALTERNATIVE D IV-109
ALTERNATIVE F IV-110

RELATIONSHIP BETWEEN SHORT-TERM USE AND LONG-TERM PRODUCTIVITY IV-111

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES IV-111

PROBABLE ADVERSE ENVIRONMENTAL EFFECTS THAT CANNOT BE AVOIDED IV-111

POTENTIAL CONFLICTS WITH PLANS AND POLICIES OF OTHER JURISDICTIONS IV-112

SPECIFICALLY REQUIRED DISCLOSURES IV-113
EFFECTS OF ALTERNATIVES ON THREATENED AND ENDANGERED SPECIES IV-113
EFFECTS OF ALTERNATIVES ON PRIME FARM LAND, RANGE LAND, AND FOREST LAND IV-113
ENERGY REQUIREMENTS OF ALTERNATIVES IV-113
EFFECTS OF ALTERNATIVES ON MINORITIES AND WOMEN IV-113
EFFECTS ON WETLANDS AND FLOODPLAINS IV-113

CHAPTER V - PUBLIC INVOLVEMENT AND COMMENTS

PAGE

INTRODUCTION V-1

SUMMARY OF PUBLIC INVOLVEMENT ACTIVITIES V-1

NATURE AND EXTENT OF PUBLIC COMMENTS V-3
- PUBLIC RESPONSE TO THE DEIS V-3
  - **Coupons** V-3
  - **Individual Written Letters** V-3
  - **Forest Product Groups/Industries** V-3
  - **Environmental/Conservation Groups** V-3
  - **Government Agencies, Municipalities, Officials** V-4
- CONTENT ANALYSIS AND EVALUATION OF COMMENTS V-4

RESPONSE TO PUBLIC COMMENT V-4
- SOILS V-6
- WATER QUALITY/FISH V-10
- VEGETATION V-21
- TIMBER V-23
- FIRE/FUELS V-28
- WILDLIFE V-31
- RECREATION V-38
- VISUAL QUALITY V-39
- ECONOMICS V-40
- PLANNING V-44
- POLICY V-50

LETTERS FROM FEDERAL AND STATE AGENCIES V-53

LIST OF COMMENTORS V-97

OTHER

PAGE

LIST OF PREPARERS LP-1

LIST OF AGENCIES, ORGANIZATIONS, AND PERSONS TO WHOM COPIES OF THE STATEMENT HAVE BEEN SENT LA-1

LITERATURE CITED LC-1

GLOSSARY GL-1
- ACRONYMS GL-28

INDEX IN-1

LIST OF FIGURES

FIGURE	TITLE	PAGE
Figure S-1	Alternative comparison by issue	S-7
Figure I-1	Vicinity Map	I-5
Figure II-1	Alternative comparison by issue	II-17
Figure II-2	Total organic material in the fire area by alternative	II-21
Figure II-3	Total erosion by alternative	II-22
Figure II-4	Volume harvested by alternative	II-23
Figure II-5	Area harvested by Silvicultural prescription by alternative	II-24
Figure II-6	Unsuitable timber lands harvested by alternative	II-24
Figure II-7	Volume growth loss over 80 years (1989-2069) by alternative	II-25
Figure II-8	Area harvested by harvest system by alternative	II-26
Figure II-9	Road construction by alternative	II-26
Figure II-10	Acres suitable interior species habitat by alternative	II-28
Figure II-11	Dead and defective tree habitat, primary cavity excavators by alternative	II-29
Figure II-12	Economic efficiency, net benefits years 1989-1990 and present net value 1989-2039 by alternative	II-30
Figure II-13	Economic and social impacts years 1989-1990 by alternative	II-31
Figure III-1	High mass wasting hazard	III-4
Figure III-2	Pre- and post-fire distribution of total organic material (TOM)	III-6
Figure III-3	Fire intensity, derived from predicted mortality	III-8
Figure III-4	Subwatershed boundaries	III-12
Figure III-5	Stream temperature increases related to pre-fire management activities	III-14
Figure III-6	Estimated stream temperatures	III-15
Figure III-7	Hills Creek temperature (August flow multiplied by temperature)	III-16
Figure III-8	Shade Index, Hills Creek watershed	III-17
Figure III-9	ARP values by subwatershed	III-19
Figure III-10	Fire behavior based on Fuel model	III-31
Figure III-11	Big-game forage/hiding/thermal cover by subwatershed	III-33
Figure III-12	Big-game habitat quality index (HQI), post-fire	III-34
Figure III-13	Interior species habitat by subwatershed, post-fire	III-36
Figure III-14	Dead and defective habitat, percentage of potential population capacity for primary cavity excavators	III-37
Figure III-15	Measurable standards and guidelines for visual quality objectives in the Shady Beach Fire Recovery analysis area	III-44
Figure III-16-A	Sold volumes from Willamette National Forest and Rigdon Ranger District	III-47
Figure III-16-B	Volumes in MMBF Willamette National Forest and Rigdon Ranger District	III-48
Figure III-17	Economic statistics for Lane and Douglas Counties	III-49
Figure III-18	Logs processed in Lane and Douglas Counties	III-50
Figure III-19-A	Population estimates Lane and Douglas Counties	III-51
Figure III-19-B	Population estimates Lane and Douglas Counties	III-51
Figure III-20-A	Payments to selected counties	III-53
Figure III-20-B	Willamette National Forest 25 percent payments	III-53

FIGURE	TITLE	PAGE
Figure IV-1	Distribution of total organic material (TOM) pre- and post-fire	IV-7
Figure IV-2	Losses of organic material by fire intensity, post-fire estimates of total organic material	IV-7
Figure IV-3	Environmental consequences of no action relating to soil productivity and erosion	IV-8
Figure IV-4	Environmental consequences of Alternative B relating to soil productivity and erosion	IV-9
Figure IV-5	Environmental consequences of Alternative C relating to soil productivity and erosion	IV-10
Figure IV-6	Environmental consequences of Alternative D relating to soil productivity and erosion	IV-12
Figure IV-7	Environmental consequences of Alternative F relating to soil productivity and erosion	IV-13
Figure IV-8	Hills Creek hydrograph mean monthly discharge, 1959-1981	IV-18
Figure IV-9	Hypothetical sediment yield through time for the Shady Beach fire area	IV-19
Figure IV-10	Large woody debris pre- and post-fire by subwatershed	IV-21
Figure IV-11	Percent of predicted increases in erosion/sediment from roads versus harvest for each alternative	IV-21
Figure IV-12	Stream temperatures of selected subdrainages for Alternative E, background, and pre-fire management	IV-22
Figure IV-13	ARP for Alternative E and pre-fire baseline by subdrainage	IV-23
Figure IV-14	Erosion Index Alternative E increases, post-fire baseline by subdrainage	IV-24
Figure IV-15	Long-term recruitment of LWD, Alternative E	IV-26
Figure IV-16	Stream temperatures of selected subdrainages for Alternative B, background, pre- and post-fire	IV-27
Figure IV-17	Change in ARP from post-fire baseline to Alternative B by subdrainage	IV-28
Figure IV-18	Erosion Index increases above post-fire baseline for Alternative B	IV-29
Figure IV-19	Percent reduction in long-term potential recruitment of LWD, Alternative B	IV-30
Figure IV-20	Stream temperatures of selected subdrainages for Alternative C, background, pre- and post-fire	IV-31
Figure IV-21	Change in ARP from post-fire baseline to Alternative C for selected subdrainages	IV-32
Figure IV-22	Erosion Index increases above post-fire baseline for Alternative C	IV-33
Figure IV-23	Percent reduction in long-term potential recruitment of LWD, Alternative C	IV-34
Figure IV-24	Change in ARP from post-fire baseline to Alternative D for selected subdrainages	IV-35
Figure IV-25	Erosion Index increases above post-fire baseline for Alternative D	IV-36
Figure IV-26	Percent reduction in long-term potential recruitment of LWD, Alternative D	IV-37
Figure IV-27	Change in ARP from post-fire baseline to Alternative F for selected subdrainages	IV-38
Figure IV-28	Erosion Index increases above post-fire baseline for Alternative F	IV-39
Figure IV-29	Percent reduction in long-term potential recruitment of LWD, Alternative F	IV-40

FIGURE	TITLE	PAGE
Figure IV-30	Estimated acres treated by prescribed burning	IV-42
Figure IV-31	Douglas-fir volume recovery by tree diameter	IV-45
Figure IV-32	Value loss for Douglas-fir by time	IV-45
Figure IV-33	Gross merchantable volume, Alternative B	IV-48
Figure IV-34	Regeneration harvest regime for Alternative B	IV-49
Figure IV-35	Gross merchantable volume, Alternative C	IV-50
Figure IV-36	Regeneration harvest regime for Alternative C	IV-51
Figure IV-37	Gross merchantable volume, Alternative D	IV-52
Figure IV-38	Regeneration harvest regime for Alternative D	IV-53
Figure IV-39	Gross merchantable volume, Alternative F	IV-54
Figure IV-40	Regeneration harvest regime for Alternative F	IV-55
Figure IV-41	Predicted fire size after one-half hour, Alternatives B and C	IV-61
Figure IV-42	Predicted fire size after one hour, Alternative D	IV-63
Figure IV-43	Predicted fire size after one-half hour, Alternative F	IV-64
Figure IV-44	Five stages of deterioration of Douglas-fir snags	IV-70
Figure IV-45	Snag diameters and decay stages most often used for cavity nesting by woodpeckers	IV-71
Figure IV-46	When they fall, trees and snags immediately enter one of four log decomposition classes	IV-71
Figure IV-47	Big-game forage/cover ratios and HQI by subwatersheds and winter ranges for year 0, Alternative E	IV-73
Figure IV-48	Big-game habitat quality index (HQI) by subwatershed, Alternative E	IV-74
Figure IV-49	Big-game forage/cover ratios and HQI by subwatersheds and winter ranges for year 0, Alternative B	IV-76
Figure IV-50	Big-game habitat quality index (HQI) by subwatershed, Alternative B	IV-77
Figure IV-51	Interior species habitat by subwatershed, Alternative B	IV-78
Figure IV-52	Dead and defective habitat percentage of potential population capacity for primary nesters for Alternative B	IV-79
Figure IV-53	Big-game forage/cover ratios and HQI by subwatersheds and winter ranges for year 0, Alternative C	IV-81
Figure IV-54	Big-game habitat quality index (HQI) by subwatershed for Alternative C	IV-81
Figure IV-55	Dead and defective habitat percentage of potential population capacity for primary nesters for Alternative C	IV-83
Figure IV-56	Big-game forage/cover ratios and HQI by subwatersheds and winter ranges for year 0, Alternative D	IV-84
Figure IV-57	Big-game habitat quality index (HQI) by subwatershed for Alternative D	IV-85
Figure IV-58	Dead and defective habitat percentage of potential population capacity for primary nesters for Alternative D	IV-86
Figure IV-59	Big-game forage/cover ratios and HQI by subwatersheds and winter ranges for year 0, Alternative F	IV-87
Figure IV-60	Big-game habitat quality index (HQI) by subwatershed for Alternative F	IV-88
Figure IV-61	Visual quality objectives by alternative	IV-95

SUMMARY

INTRODUCTION

This Final Environmental Impact Statement (FEIS) describes alternative courses of action in response to conditions within the Shady Beach Fire Recovery Project Analysis Area. This area contains about 22,456 acres within the Rigdon Ranger District of the Willamette National Forest and contains 9,163 acres that burned in September of 1988. About 1,040 acres in the analysis area are privately owned and 880 acres of this private land was burned.

Five alternatives for managing the land and resources in this area have been evaluated. Alternative C, Salvage under direction in the Proposed Forest Plan, has been identified by the Forest Supervisor as the preferred alternative.

In this summary, the purpose of these proposals is identified, issues identified during the planning process are listed, environmental components of the analysis area are described, the range of alternatives developed to address these issues is listed, and the alternatives are described and compared. The comparison of alternatives illustrates many of the important environmental consequences of these proposed actions.

Copies of this FEIS can be obtained from the Rigdon Ranger Disrtict, 49098 Salmon Creek Road, Oakridge, Oregon 97463 (phone: 503-782-2283). The Shady Beach Fire Recovery Project Analysis File, a collection of supporting documents and records of the analysis process, is also available for viewing at this location.

PURPOSE AND NEED

This FEIS was written in compliance with the National Environmental Policy Act of 1969 (NEPA) and was prepared to determine what site specific projects, if any, should be implemented to salvage fire-killed timber and to rehabilitate the resources affected by the fire.

The purpose of these proposed activities relates to the following three needs; 1) the need to implement projects designed to minimize further impacts from the fire; 2) the need to salvage fire-killed timber before various damaging agents render it valueless; and 3) the need to reforest the area quickly in order to maintain long-term biological potential of the burned area.

ISSUES, CONCERNS, AND OPPORTUNITIES

Immediately following the control of the Shady Beach fire in late September, Willamette National Forest personnel began identifying the issues, concerns, and opportunities that were expressed by various people concerned with how the effects of the Shady Beach fire should be dealt with. This scoping process involved several public meetings, a review of written comments solicited by mailers sent to many individuals and organizations, and contact with several citizen's groups that have shown past interest in Forest Service programs or in the specifics of the Shady Beach Fire Recovery Project.

The following issues were identified by these processes and served to direct the formation and evaluation of alternative action strategies:

1. SOILS: Soil erosion and changes in nutrient cycling, specifically losses of nutrients, or organic material that serve as nutrient reserves, may affect long-term site productivity. There is a concern that site productivity may be further reduced by salvage harvest activities through nutrient losses and acceleration of soil erosion.

2. WATER QUALITY/FISH HABITAT: Increased erosion from the fire and from subsequent salvage harvest activities may reduce water quality in streams and in Hills Creek Reservoir. Increased erosion and corresponding increase in sediment and turbidity are related to the erosion index. Increased peak flows are related to a reduction in the aggregate recovery percentage (ARP) of watersheds in the analysis area. Increased erosion may cause water quality and fish habitat changes in streams within the analysis area. Also affected is Hills Creek Reservior which is located immediately adjacent to and downstream from the fire and analysis area. Fish, the primary beneficial users in the analysis area, are sensitive to natural and human-caused sedimentation, increases in temperature, and changes in potential recruitment of large woody debris (LWD).

3. TIMBER: There is a concern that killed or damaged timber will deteriorate to the point that significant amounts of commercial products will be irretrievably lost. There is also a concern that

reforestation efforts would be hampered if prompt road access to all areas of mortality is not provided through roads built for salvage harvest.

4. WILDLIFE HABITAT: The fire has destroyed or diminished a number of structural wildlife habitat features including defective trees, down logs, various types of vegetative cover, and old-growth forest stands. The concern is that salvage of fire mortality may compound the effects that the fire has had on these components of wildlife habitat.

5. VISUALS/RECREATION: The scenic quality of views from Forest Roads 21 and 23 and the campground and day-use sites near the analysis area is important to the extent that it affects the quality of recreational experiences in the area. The concern is that salvage harvesting may add to the effects that the fire has had on these scenic resources and the resultant conditions would not meet current prescriptions for these portions of the Middle Fork viewshed.

6. SOCIAL/ECONOMIC: There is a concern that salvage harvest should be conducted to yield the highest present net value in order to contribute as much as possible to the Federal treasury and county funding.

AFFECTED ENVIRONMENT

The Shady Beach Analysis Area is located in Lane County, Oregon in the Rigdon Ranger District of the Willamette National Forest. It is within the Middle Fork of the Willamette River drainage and is immediately adjacent to the Hills Creek Reservoir. This reservoir is maintained by the U.S. Army Corps of Engineers.

The climate of the area is influenced by marine air flow from the Pacific Ocean, which is some 90 miles to the west. Annual precipitation ranges from 31 to 59 inches, most of which falls during the winter and spring months. Summers tend to be warm and dry.

Elevations in the analysis area range from 1,500 feet above sea level at the surface of the reservoir to nearly 6,500 feet at the summit of Wolf Mountain. The topography in the area is quite variable; there are many steep slopes and deeply incised stream channels but a large portion of the area has gentle, rolling topography resulting from ancient landflows.

Soils in the area are generally very productive but are fine textured and somewhat susceptible to erosion, especially mass movement.

There are almost 56 miles of permanent streams in the analysis area. Nineteen of these miles contain populations of native and stocked trout and other non-game fish species. The Hills Creek Reservoir also contains trout and other stocked game fish species. Water quality in the streams is good, although there will be some increases in turbidity, sediment movement, and water temperature associated with fire effects. Hills Creek Reservoir is usually somewhat turbid due to the large amount of fined textured soils in the Middle Fork watershed and the configuration of the outlet structure.

The analysis area is covered by forests dominated by Douglas-fir. These forests range from clearcuts that have been recently planted to stands over 400 years old. About 32 percent of the area in covered by plantations ranging in age from 1 to 40 years. Approximately 19 percent of these stands have old-growth characteristics consisting of mature and over-mature trees of several age classes and abundant standing and down dead trees. There are no known threatened or endangered plant species occurring in the area, though there are several species considered to be sensitive to management activities.

The analysis area contains a variety of animal species that are typical of those found in the southern Cascade mountains. It contains important Roosevelt elk and blacktail deer winter range. Bald eagles, Federally listed as endangered, occur in the area and use the reservoir for fishing and the trees along the reservoir shores for perching. The northern spotted owl, listed by the State of Oregon as endangered and considered sensitive by the Forest Service also occurs in the area. There are no other threatened or endangered animal species known to occur in the area.

There are several well-used, developed recreation sites on the Hills Creek Reservoir consisting of a campground, several picnic areas, boat ramps, and a swimming beach. The reservoir is much used in the summer for fishing, boating, swimming, and water skiing. The area along the reservoir is managed to maintain the scenic quality of the area as viewed from Forest Road 21 and the reservoir.

The effects that the fire had on the resources within the analysis area are discussed in detail in Chapter III, the Affected Environment section of this FEIS, as well as other portions of the document. In addition to the fire-kill of almost 135 million board feet of gross, merchantable timber, the fire had important effects on wildlife habitat, water quality, and long-term site productivity. There were some minor direct fire effects on soils but most of the site productivity effects involve reductions of organic material that affects nutrient supplies to the soil. Mass wasting would be increased on steeper slopes near stream channels where the fire has consumed all slope stabilizing woody material.

ALTERNATIVES

Alternatives were developed by an Interdisciplinary (ID) Team of specialists that was recruited to study the analysis area. This ID Team developed and evaluated various alternatives which addressed one or more of the issues identified to guide the development of this project. These specialists were selected to provide professional expertise in the various resources occurring in the analysis area. This alternative development was done under the guidance of a Board of Directors composed of the Rigdon Ranger District Ranger and several staff members of the Willamette National Forest Supervisor's Office.

Each alternative was developed to address one or more of the issues. The alternative range considered a No Action Alternative and a Maximum Timber Salvage Alternative which served as sideboards to which all other alternatives were developed. The Maximum Timber Salvage Alternative was not fully developed. This alternative would have significant effects on water quality in addition to reducing wildlife habitat below current standards.

Several other alternatives or parts of alternatives were considered but not given detailed study. In addition to the Maximum Timber Salvage Alternative, a No Change Alternative was also eliminated from detailed study. This alternative would have continued forest management as originally proposed in the Rigdon Ranger District's 10-year timber-sale action plan. This alternative was not developed as continuation of the timber-sale action plan would not be realistic. Future sales in the fire areas would no longer be feasible or economically efficient as fire-killed timber is expected to have little value in the future due to deterioration.

The alternatives that were considered viable and that offered a complete range of timber salvage and resource protection were fully developed, analyzed and are described as follows:

ALTERNATIVE E NO ACTION, ENVIRONMENTALLY PREFERABLE

No timber harvest would occur in this alternative with the exception of the removal of trees that could pose a safety hazard to users of Forest roads and facilities. Recovery of previously unmanaged portions of the analysis area would depend on natural processes. Rehabilitation of fire effects would occur only where necessary to prevent or correct immediate resource damage. Artificial reforestation would occur only in plantations damaged by the fire. A designated bald eagle management area (BEMA) would be retained in the southwestern corner of the analysis area. This alternative would not meet the Proposed Forest Plan/DEIS standards and guidelines for timber management.

This alternative has been identified as one of two alternatives, both which are environmentally preferable. Environmentally preferable refers to the alternative(s) that causes the least damage to the biological and physical environment; it also means the alternative(s) which best protects, preserves, and enhances historic, cultural, and natural resources.

ALTERNATIVE B

In this alternative, all dead, damaged, and incidental green trees necessary to provide efficient harvest units would be harvested totaling 166 million board feet on 4,695 acres. Approximately 21 miles of road would be constructed. Regeneration harvest would occur if, due to fire mortality, forest canopy closure is below 70 percent. The BEMA would be retained. Limited stream buffers would be retained along all permanent streams and two trees per acre would be left standing in regeneration harvest areas for wildlife use on at least 40 percent of the analysis area. This alternative would meet the direction in the 1977 Willamette National Forest

Land Management Plan (Current Forest Plan/FEIS) as well as interim Regional and Forest direction.

ALTERNATIVE C
PREFERRED
ALTERNATIVE

In this alternative all dead or damaged trees and incidental green trees would be harvested. Green trees would be harvested to provide for efficient and logical harvest units where this would not compromise any of the previously mentioned resources. Approximately 144 million board feet of timber would be harvested on 4,609 acres, involving the construction of 18 miles of road. A pileated woodpecker habitat area (PWHA) would be designated in the southwestern corner of the analysis area, along with the BEMA. Streamside buffers would provide for protection of all permanent streams and intermittent streams that flow through unstable topography. Approximately four trees per acre would be retained for wildlife use on at least 40 percent of the area where this number of suitable trees exist. This alternative complies with direction in the standards, guidelines, and land allocations contained in the Draft Willamette National Forest Land and Resource Management Plan/DEIS (Proposed Forest Plan/DEIS).

ALTERNATIVE D

This alternative would salvage only dead timber. No green trees would be cut to facilitate efficient harvest unit placement. Approximately 133 million board feet would be harvested on 4,702 acres. No roads would be built. About 50 percent of the areas harvested would be accessed by helicopter yarding systems to avoid the impacts associated with road construction. Riparian areas, wildlife tree habitat, and the BEMA and PWHA would be managed as described in Alternative C. All activities would attempt to meet the standards and guidelines contained in the Proposed Forest Plan/DEIS where they have not already been compromised by effects of the fire.

ALTERNATIVE F
ENVIRONMENTALLY
PREFERABLE

Salvage of fire-killed timber would be subordinate to protection and enhancement of wildlife, water, and soil resources. A total of 96 million board feet of timber would be harvested on 2,566 acres, requiring the construction of 11 miles of road. Green trees would be harvested to provide for efficient and logical harvest units where this would not compromise any of the previously mentioned resources. All proposed activities would meet or surpass the standards and guidelines contained in the Proposed Forest Plan/DEIS. The BEMA and pine marten habitat area (PMHA) would be retained as well as a spotted owl habitat area (SOHA) in the Bull Creek drainage. Three PMHAs would also be designated to further provide habitat for old-growth dependent species. Riparian areas would be provided as described in Alternatives C and D. Approximately seven trees per acre would be retained for wildlife habitat on all acres in the analysis area. This alternative would not meet the Proposed Forest Plan/DEIS standards and guidelines for timber management. All other standards and guidelines would be met where they have not already been compromised by the effects of the fire.

This alternative has been identified as one of two alternatives, both which are environmentally preferable. Environmentally preferable refers to the alternative(s) that causes the least damage to the biological and physical environment; it also means the alternative(s) which best protects, preserves, and enhances historic, cultural, and natural resources.

COMPARISON OF ALTERNATIVES

The alternatives are compared in reference to the issues already presented. For each issue, a number of key indicators were developed to assist in measuring or otherwise determining how each alternative performed in reference to a given issue. These comparative effects are summarized in Figure S-1.

ALTERNATIVE COMPARISON BY ISSUE

SOILS

INDICATOR	B	C	D	F	E
Total Organic Material* (tons/acre) in fire area	206	216	222	245	291
Total Erosion Rate* 1)(cu.yds/acre/yr) in analysis area	1.20	1.19	1.15	1.17	1.14

1) Combination mass-wasting potential and surface soil erosion
* Key Indicator

WATER QUALITY / FISH HABITAT

INDICATOR	B	C	D	F	E
STREAMS					
---mean maximum temperature* 1) (degrees F)	57.9	57.5	57.5	57.4	57.4
---Erosion Index (cu.yds/yr)	2600	2570	2470	2520	2460
---aggregate recovery percent(ARP)* 2)	44	45	46	47	48
---impacts on potential long-term recruitment of LWD* 3)	H	M	M	L	L
RESERVIOR					
---water temperature* 3)	L	L	L	L	L
---increased turbidity*	<2%	<2%	<1%	<1%	4%
---increased sediment delivered (cu.yds/yr)*	900	878	798	832	779

Values include reductions for mitigation
1) Average of most Class II and III streams during August (weighted by flow)
2) Weighted average of subdrainages for the analysis area
3) LWD = Large Woody Debris, L=Low, M=Moderate, H=High
N/S Not Significant
* Key Indicator

Figure S-1 Alternative comparison by issue

ALTERNATIVE COMPARISON BY ISSUE

TIMBER

INDICATOR	B	C	D	F	E
Volume Harvested (MMBF) (gross merch. volume) 1989-1990					
----dead & potentially dead*	141	130	133	91	0
----green*	25	14	0	5	0
----Total	166	144	133	96	0
Mortality Not Harvested (MMBF) (gross merch. volume)	13	18	15	57	148
Area Harvested by Silvicultural Prescription (acres)					
----partial cut	1694	2063	2713	579	
----regeneration cut					
........clearcut	2806	2372	1891	1920	0
........shelterwood	195	188	98	67	0
Total Regeneration Cut	3001	2560	1989	1987	0
Total Acres Harvested	4695	4623	4702	2566	0
Unsuitable Timber Land Harvested* (acres)	195	171	137	156	0
Timber Volume Growth Loss* (MMBF) 1989-2069	129	142	172	246	843
Harvest System (acres)					
----cable					
........highlead	96	112	101	93	0
........skyline	4101	3934	2120	2171	0
----helicopter	495	563	2481	302	0
Area Reforested (acres) 1)	4611	4184	3628	3645	1795
Road Construction (miles)	21.2	18.1	0	11.2	0

1) Includes Existing Plantations

* Key Indicator

Figure S-1 Alternative comparison by issue

ALTERNATIVE COMPARISON BY ISSUE

WILDLIFE HABITAT

INDICATOR	B	C	D	F	E
BIG-GAME					
—forage/hiding/thermal cover* (ratio) 1)	74-9-17	72-11-17	62-19-19	62-11-27	59-11-30
—Habitat Quality Index* (HQI) 2)					
........Year 0	0.57	0.56	0.55	0.59	0.61
........Year 9	0.51	0.53	0.49	0.55	0.54
........Year 22	0.35	0.36	0.35	0.38	0.39
OLD-GROWTH DEPENDENT SPECIES					
—Designated Habitat (acres)					
........Northern Spotted Owl*	0	0	0	1500	0
........Pileated Woodpecker*	0	300	300	300	300
........Pine Marten*	0	160	160	480	160
INTERIOR HABITAT INDEX* (IHI) 2)	0.40	0.40	0.40	0.41	0.41
........# of Habitat Patches	13	13	13	16	16
........available habitat (acres)	4222	4222	4251	5660	5701
DEAD AND DEFECTIVE TREE HABITAT					
Primary Cavity Excavator Species					
% pop. capacity Year 0	46.2	49.6	51.9	69.2	69.2
% pop. capacity Year 30	39.6	47.7	46.2	52.9	52.9
THREATENED, ENDANGERED, & SENSITIVE SPECIES					
—Suitable Habitat (acres)					
........Bald Eagle Potential Nest Sites*	660	660	660	660	660
........Bald Eagle Perching Habitat*	206	206	206	206	206
........Plant Species Habitat*	150	150	150	150	150
RIPARIAN HABITAT EFFECTED (acres)	1038	820	840	399	256

1) Average of subwatersheds significantly impacted by fire
2) Weighted average for all effected subwatersheds
* Key Indicator

Figure S-1 Alternative comparison by issue

ALTERNATIVE COMPARISON BY ISSUE

VISUALS / RECREATION

INDICATOR	B	C	D	F	E
Land Allocation					
---Retention Foreground					
........Forest Plan harvest rate per decade*	5	5	5	5	5
........first decade harvest rate (% of area)*	14	10	9	9	0
---Partial Retention Middleground					
........Forest Plan harvest rate per decade*	10	10	10	10	10
........first decade harvest rate (% of area)*	35	26	21	19	0
Recovery Rate of Vegetation to meet VQOs* 1) (years)	30	30	30	30	30

1) Visual Quality Objective
* Key Indicator

SOCIAL / ECONOMIC

INDICATOR	B	C	D	F	E
Economic Efficiency					
---net benefits* (mm$) 1989-1990	38.3	33.5	31.5	23.0	-0.7
---present net value* (mm$) 1989-2039	103.8	98.0	98.2	88.6	77.0
Economic & Social Impacts 1989-1990					
---county revenues* (mm$)	10.5	9.4	8.6	6.6	0
---jobs* (number,direct)	903	820	763	560	6
---wage income* (mm$)	18.5	16.8	15.6	11.5	.125

* Key Indicator

Figure S-1 Alternative comparison by issue

SOILS

Any amount of organic material on a site contributes to soil nutrient status and condition. Information is lacking about the effects of removing soil-organic material on soil productivity. However, we can use estimates of total organic material to infer relative differences between alternatives. Alternative B would remove the greatest amount of merchantable material and slash and would result in retaining 71 percent (206 tons/acre) of the total organic material. The difference between this and leaving all of the organic material under Alternative E infers a relative difference in soil nutrient reserves and does not indicate a significant difference in soil productivity between alternatives.

Varying amounts of road construction and regeneration harvest would contribute to predicted erosion rate differences between alternatives. Alternative B is predicted to produce the greatest amount of potential total erosion (1.20 cu.yds./ac./yr.). Alternative E is predicted to have an erosion rate of 1.14 cubic yards per acre per year resulting from high intensity burns on areas with potentially high erosion rates.

WATER QUALITY/ FISH HABITAT

Summertime temperatures of Class II and III streams in harvest areas would increase to some extent. However, mitigation measures which restrict harvest in riparian areas in Alternatives C, D, and F would result in unmeasurable stream temperature increases. Implementation of Alternative B would result in significant temperature increases in several streams due to reduced shade.

The hydrologic condition of the analysis area as measured by the aggregate recovery percentage (ARP) would vary by 4 percent between Alternatives B and E. The ARP reductions from Alternatives E to B correspond to the amount of green timber that would be harvested. A closer look at individual subdrainages shows that ARP would take a sharper reduction in some subdrainages under Alternatives B and C.

Sediment yield and turbidity would increase in all action alternatives due to increased soil erosion rates as a result of timber harvesting and road construction. The Erosion Index is a relative indicator of potential sediment delivery with no mitigation above Best Management Practices (BMPs). The Erosion Index is used, along with fire intensity and fisheries, to identify sensitive or high risk subdrainages that will require additional mitigation measueres above BMP mitigation. Erosion Index values for Alternative B indicate that implementation of this alternative would have a high potential of generating significant sediment and turbidity increases in three subdrainages. Index values for implementation of Alternatives C and F would indicate a high potential of generating significant sediment and turbidity increases in two subdrainages and implementation of Alternative D would indicate a low potential of generating significant sediment and turbidity increases. The fisheries and angler beneficial uses would not be measurably affected because predicted turbidity increases occur during winter and spring high flows. Alternatives B, C, D, and F would not significantly increase water temperature, sediment yield, or turbidity in Hills Creek Reservoir.

TIMBER

Timber harvested within the project area would be included as part of the sale volume normally sold on the Willamette National Forest. Harvest volumes displayed in Figure S-1 are volume estimates that would be removed during 1989 and 1990. Alternative B would harvest the most dead and green volume. The greatest difference between Alternatives C and D would be the amount of green volume removed. Alternative D would have the greatest number of acres partial cut and harvest slightly more dead timber than Alternative C. Alternative B would harvest the most acres of land unsuitable for reforestation and Alternative F the least.

Volume growth loss represents the amount of growth lost due to not salvaging and actively reforesting fire-killed areas. Alternative B would have the lowest growth loss and Alternative E the highest.

Alternative D would harvest significantly more area by helicopter than the other alternatives. Alternative B would result in the greatest amount of new road construction.

WILDLIFE HABITAT

Figure S-1 displays overall effects on wildlife habitat for big game, old-growth dependent species, interior forest-dependent species, dead and defective trees, threatened, endangered, and sensitive species, and riparian-dependent species.

Big-game forage and hiding cover habitat quality would decline by Year 22 under all alternatives. This would occur primarily because the initial forage increase contributing to habitat viability in Year 0 would grow into hiding cover contributing to marginal habitat viability by Year 22. This situation would be more pronounced under Alternatives B and C as they substantially contribute additional forage beyond what the fire created. Alternative D, however, would neither benefit nor harm the short- or long-term habitat quality as it would not remove any functional thermal cover nor would it produce much additional high quality forage vegetation.

Alternatives E and F would provide for the best habitat quality throughout the next 2 decades. This is because these alternatives would maintain the limited low-elevation winter range thermal cover in the short-term to sustain big-game populations through severe winters. Alternatives E and F would also help provide for long-term forage needs because maintaining blocks of green timber now would provide future opportunities to either harvest some timber to create forage, or maintain timber stands for thermal cover. Alternative D would also maintain future options to create forage through scheduled timber harvest.

Big-game thermal cover differs by up to 15 percent between Alternatives B and E. Partial cut stands presently provide minimum crown closure for thermal cover. It is assumed that harvest activities in partial cut stands would create enough crown damage so that these stands would no longer meet thermal cover requirements.

There are subtle differences between action alternatives in the amount of interior forest-dependent species habitat provided for such species as the northern flying squirrel, red backed vole, and Oregon slender salamander. More specific trend differences are apparent when looking at the total number of habitat patches and habitat acres that would remain after implementation of different alternatives. Alternatives E and F would provide more habitat patches, substantially more acres, and two important patches in the critical habitat connection corridor along Hills Creek compared with Alternatives B, C, and D.

The potential percent population capacity for primary cavity excavator (woodpecker) habitat was estimated through identifying dead and defective tree habitat. Alternative B would exceed the Forest Service Region 6 direction for maintaining this habitat at greater than 40 percent. The other alternatives would meet or be better than this direction.

In terms of providing suitable habitat acres for old-growth dependent, threatened, endangered, and sensitive species, the main difference between alternatives is that Alternative B would not designate acres for old-growth dependent species habitat, and Alternative F would designate 1,500 acres of future spotted owl habitat. Alternatives C and D would both provide several smaller blocks of old-growth for old-growth dependent species. Changes to riparian habitat would have a direct correlation to the number of acres harvested; Alternative E causing the least amount of change and Alternative B providing the most.

VISUALS/RECREATION

None of the action alternatives would meet the visual quality objectives established for the analysis area. All the action alternatives would not meet the first decade harvest rates specified in the Proposed Plan/DEIS standards and guidelines (5 percent for retention and 10 percent for partial retention). The No Action Alternative left natural patterns on the landscape. The fire itself is considered a natural process and has not caused any visually degrading disturbance.

The visual quality recovery period is based on the estimated time it would take for a relatively closed forest canopy to become re-established.

SOCIAL/ECONOMIC

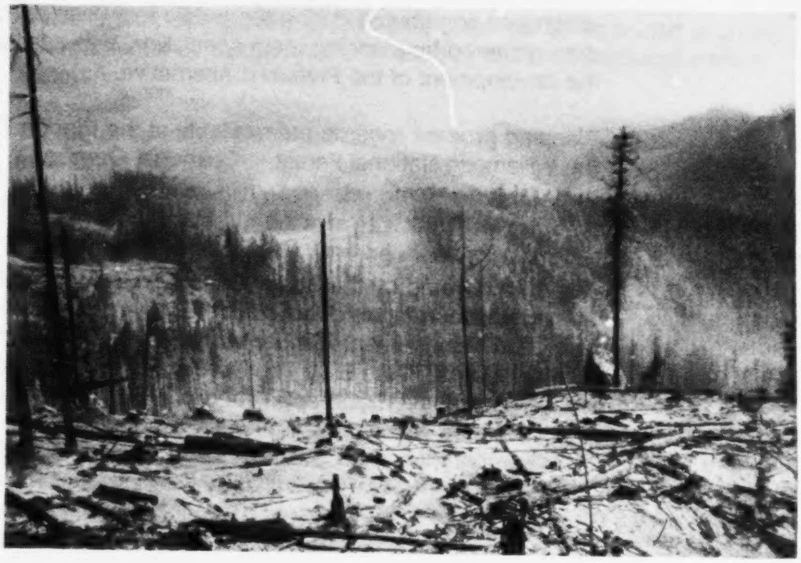
The economic efficiency analyses display absolute and relative monetary trade-offs between the alternatives. The timber resource was the only resource assigned a market value. Therefore, net benefits, present net values (PNV), and jobs and wage incomes were determined by; 1) the timber volumes sold, 2) log production costs, and 3) the mitigation costs associated with volume reductions (e.g. wildlife trees) required to implement the timber sales program for each alternative.

PNV and net benefit range from Alternative B (highest) through Alternatives C, D, F, and E (lowest).

Payments to county and Federal treasuries was estimated for 1989 and 1990. Generally, alternatives that harvest more timber relative to others provide more revenue to the treasuries. However, this difference does not hold true on a per MBF basis for all alternatives. For example, Alternatives C and D harvest similar volumes but return fewer dollars on a per MBF basis to the Federal and county treasuries. The logging costs would be $14/MBF higher in Alternative D ($116/MBF) than in Alternative C ($102) due primarily to the increase in helicopter units in Alternative D. The increase in the logging costs between alternatives would reduce receipts to the Federal treasury and revenue sharing payments to county governments. The trade-off for the decreased dollar returns per MBF in Alternative D is that no green volume would be harvested and there would be no new road construction.

Jobs and income dollars generated from timber salvage sales were estimated for the two year salvage operation and for green sales in the next 5 decades. Alternative E would provide very few jobs and Alternative B would provide over 900. These include logging, mill, tree planting, road construction and maintenance, and Forest Service jobs.

PURPOSE AND NEED



INTRODUCTION

The decision to prepare an Environmental Impact Statement (EIS) was made as a result of a Forest Service proposal to salvage timber burned in the Shady Beach fire. The actual decision to prepare an EIS was influenced by concerns about the direct, indirect, and cumulative effects of proposed salvage of fire-killed timber on resources of the area and on the quality of the human environment.

This EIS is prepared in accordance with the National Environmental Policy Act of 1969 (NEPA). NEPA requires the preparation of such documents when major Federal actions may significantly affect the quality of the human environment.

The primary purpose of an EIS is to fully and fairly disclose the environmental consequences of implementing various proposed alternatives, including the proposed action, for well informed decision-making. Equally important, an EIS provides the public with information about the environmental consequences of different alternatives and encourages public participation in the development and refinement of that information.

Over 6,700 responses to the Draft EIS (DEIS) were received during the 45 day comment period. Many comments were incorporated into this Final EIS (FEIS) and Chapter V of the document contains the Forest Service response to substantive comments.

The purpose of a DEIS is to provide an environmental analysis sufficiently detailed to help decision-makers select a management plan. It also provided the public with information about the environmental consequences of different management alternatives and encouraged public participation in the development and refinement of that information.

This FEIS is the next stage in the process. New information, both that which was contributed during the public response period and additional data gathered by planning team specialists, was evaluated. This led to the development of the Preferred Alternative.

Planning process records are available at the Rigdon Ranger District of the Willamette National Forest in Oakridge, Oregon.

MANAGEMENT DIRECTION

The area covered by the Shady Beach Fire Recovery Project is currently managed according to direction in the Willamette National Forest Multiple-Use Land Management, Timber Management Plan, and Final EIS of 1977 (Current Forest Plan/FEIS). The direction in the Current Forest Plan/FEIS will be superseded upon approval of the Willamette National Forest Land and Resource Management Plan. A proposed Land and Resource Management Plan and DEIS (Proposed Forest Plan/DEIS) was published in December of 1987. Preparation of the Land and Resource Management Plan is required by the Forest and Rangeland Renewable Resource Planning Act of 1974 (RPA), as amended by the National Forest Management Act of 1976 (NFMA).

The Current Forest Plan/FEIS specifies two land allocations for the project area. These are the Scenic Influence II lands, along Hills Creek Reservoir and the Hills Creek road, and General Forest on the remaining area.

The preferred alternative in the Proposed Forest Plan/DEIS allocates a scenic viewshed adjacent to the reservoir and eliminates the scenic corridor along the Hills Creek road, with most of the remaining area also allocated to General Forest. There are several small areas of special habitat allocated to wildlife, old-growth, and lakeside uses.

For the purpose of this analysis, the assessment of effects assumes compliance with policies and standards established in the Willamette National Forest Multiple-Use Land Management, Timber Management Plan, and Final EIS (1977), Regional standards, guidelines, and other policies, and Federal laws and National Policies. When the Willamette National Forest Land and Resource Management Plan is approved, Standards and Guidelines in that document will apply to planning and management of the analysis area.

PURPOSE AND NEED

The purpose of this analysis is to determine what, if any, site-specific projects should be implemented for recovery of the fire area and salvage of the timber. Site-specific project proposals will be examined and their environmental consequences disclosed in this Environmental Impact Statement.

The purpose of the proposed action is: 1) to implement recovery projects minimizing further adverse impacts in the area; 2) to salvage fire-killed or damaged timber while protecting other resource values; and 3) to reforest burned areas quickly in order to maintain their long-term biological potential. This purpose is consistent with the management direction in the Current Forest Plan/FEIS.

The fire also caused non-timber-related damage. Wildlife and fish habitat was damaged or destroyed, and riparian areas and stabilizing woody material in stream channels were partly or completely removed by the fire. Water quality has been lowered. There are a number of rehabilitation and enhancement opportunities, such as planting forage plants for wildlife, planting riparian vegetation, or replacing stabilizing woody material in stream channels, that can be employed to mitigate the effects of the fire. Many of these projects can be funded by monies collected from timber salvage receipts.

The benefits of salvaging fire-killed timber quickly are many, but the most important is to minimize deterioration of the dead trees. If dead trees are not promptly utilized, the past timber product productivity of the land will be irretrievably lost. The Current Forest Plan/FEIS took past productivity and standing volume into account when developing the allowable harvest levels. In addition, there is a possibility that, over time, the dead trees could result in a buildup of forest pest populations, such as cambium-girdling and wood-boring insects, that could damage nearby healthy stands in the future. As stands of dead trees deteriorate, they will contribute to fuel-loading, creating a future high hazard for wildland fire.

In order to return fire-damaged land to its former productive level, dead forest stands should be promptly reforested. This will minimize future soil erosion that could, in turn, affect the quality and productivity of other resources in the area. Prompt reforestation can also enhance wildlife and scenic quality.

The decision to be made is what, if any, site-specific projects should be undertaken. Projects considered include: resource enhancement and recovery, timber salvage, and reforestation.

OVERVIEW OF THE ANALYSIS AREA

The 22,456-acre Shady Beach Fire Recovery Project analysis area is located in the Hills Creek and Middle Fork Willamette River drainages. Approximately 9,163 of these acres are within the Shady Beach fire perimeter. The 13,293 unburned acres that were included are to provide for analysis of cumulative effects on water quality, wildlife habitat, and scenic quality of the area. The area is administered by the Rigdon Ranger District, Willamette National Forest, Lane County, Oregon.

The boundary of the analysis area was established by including all subwatersheds in which the fire occurred. The analysis area is located 4 miles southeast of Oakridge, Oregon (see Figure I-1).

The analysis area, largely roaded, is characterized by heavily vegetated, steep, and highly dissected slopes east of Hills Creek Reservoir and south of Hills Creek, and by steep to gently rolling topography north of Hills Creek.

Before the fire, the area included heavily timbered, mature forest stands, and harvest areas in various age classes ranging from recent clearcuts to 40-year-old plantations. Tree species in natural stands include Douglas-fir, western hemlock, incense cedar, western redcedar, grand fir, sugar pine, ponderosa pine, black cottonwood, chinquapin, western yew, and madrone.

Most of the sites in the project area, with soils derived from volcanic tuffs and breccias, are highly productive timberland and are among the most productive sites on the Rigdon Ranger District. Some upper elevation sites with soils of intrusive-igneous origin are less productive. Many land types in the project area are classified as potentially unstable, with historical evidence of slides and debris flows, especially along stream channels. Forest soil scientists and silviculturists have classified less than 6 percent of the area as unsuitable for timber production (as defined by the Code of Federal Regulations guideline 36 CFR 219.12(b), "Tentative Suitability for Timber Production") due to reforestation or instability problems.

Black-tailed deer, elk, black bear, cougar, and numerous non-game animals occupy the area. Resident populations of rainbow and cutthroat trout inhabit the major streams. Old-growth and mature forests provide habitat for northern spotted owls and many other species dependent on mature stands. A pileated woodpecker habitat area (PWHA) and an area established for potential bald eagle nesting occurs within the area. However, no known bald eagle nesting sites have been observed.

Hills Creek Reservoir and the Middle Fork of the Willamette River are used primarily for recreation by Oakridge/Westfir residents, and, to a lesser extent, by Eugene/Springfield residents. This area offers a number of recreational opportunities including fishing, boating, camping, swimming, and sightseeing.

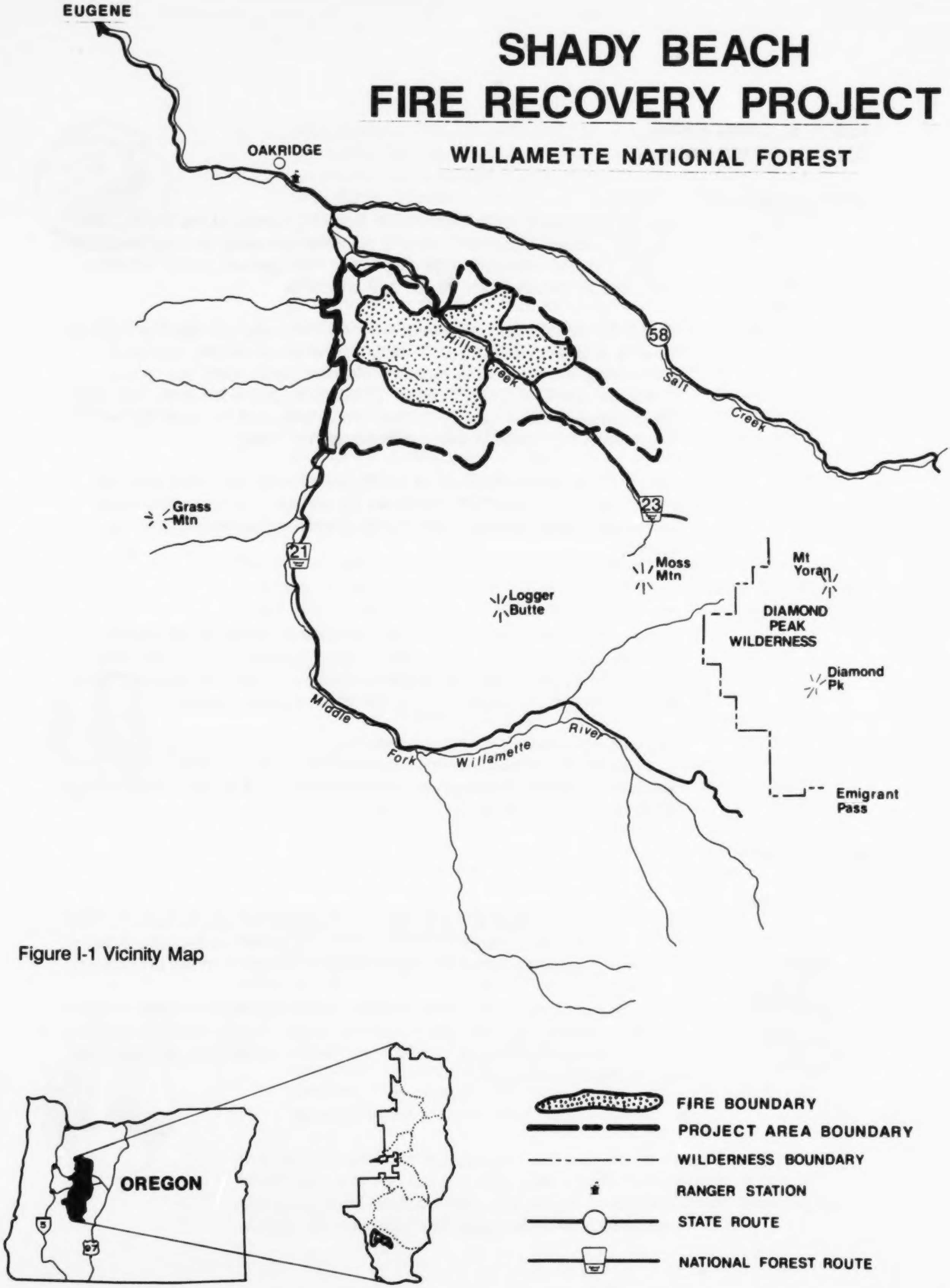


Figure I-1 Vicinity Map

ISSUES, CONCERNS, AND OPPORTUNITIES

INTRODUCTION

On September 28, 1988, immediately following control of the Shady Beach fire, an intensive public involvement plan was prepared and implemented to solicit public comment regarding future management of the recovery area and to identify major issues and concerns.

Forest Service scoping is the process for determining the significant issues relating to a proposed action. It includes: review of written comments solicited by mailers sent to many individuals; public meetings held in Oakridge, and in Eugene, Oregon; public tours of the fire area; and local news releases. More than 350 written comments and requests for further information and updates were returned to the Forest.

Scoping also included review of the Current Forest Plan/FEIS and the Proposed Forest Plan/DEIS. Pertinent issues from these sources were addressed along with the public scoping process to develop the key issues.

ISSUE IDENTIFICATION

Issues raised included the social and economic effects of fire recovery and fire-recovery effects upon water quality, fisheries, soils (slope stability, erosion, and productivity), visual quality, recreation, and wildlife (threatened, endangered, and sensitive, and game and non-game species).

Statements reflecting specific concerns for each issue are listed below. Key indicators are then identified which will be used to analyze the relative differences between alternatives. Specific terminology for each key indicator is defined in the glossary.

Discussion of Issues and Key Indicators

1. SOILS: At issue is the protection of long-term soil productivity. Soil erosion and changes in nutrient cycling affect productivity. Analysis of this issue will evaluate relative effects on long-term site productivity.

The key indicators for this issue include: 1) amount of total organic material (TOM) remaining, 2) total erosion rate consisting of mass-wasting potential (which includes landslides, debris flows, debris avalanches and slumps), and surface-soil erosion.

2. WATER QUALITY/FISH HABITAT: This issue is derived from concerns about the potential for increased erosion due to ground disturbance associated with salvaging fire-damaged timber and the increased peak flows. Increased erosion and corresponding increase in sediment and turbidity are related to the erosion index (see Water Quality section of Chapter IV for an explanation of the erosion index). Increased peak flows are related to a reduction in the aggregate recovery percentage (ARP) of watersheds in the analysis area. (See the Water Quality section of Chapter III for an explanation of ARP). Increased erosion may cause water quality and fish habitat changes in streams within the analysis area. Also affected is Hills Creek Reservoir which is located immediately adjacent to and downstream from the fire and analysis area. Fish, the primary beneficial users in the analysis area, are sensitive to natural and human-caused sedimentation, increases in temperature, and changes in potential recruitment of large woody debris (LWD). This analysis will measure the degree to which the alternatives considered effect water quality standards and Willamette National Forest management standards and guidelines.

The key indicators for this issue include: 1) streams - a) water temperature, b) erosion index, c)aggregate recovery percentage (ARP), and d) large woody debris; and 2) reservoir - a) water temperature, b) turbidity, and c) total sediments.

3. TIMBER: There will be a decline in net timber volume and a reduction in commercial value, over time, proportionate to the delay in harvest of the killed or damaged timber. Prompt harvest will recover the maximum commercial volume and value. In addition, prompt access to timberland capable of timber production will maximize reforestation success, helping to restore sites to their long-term (potential) biological productivity. If harvest is delayed, the risk of regeneration failure increases and control of the competing vegetation will become increasingly difficult. This analysis will measure the degree to which the alternatives recover and utilize the timber resource.

The key indicators for this issue include: 1) volume harvested of dead, potentially dead (predicted to die within 1 year), and green timber; 2) harvested acres of land unsuitable for timber management because of soil instability or conditions that prevent reforestation of the site; and 3) timber volume growth loss.

4. WILDLIFE HABITAT: Fire effects on wildlife habitat, including old-growth-dependent species, may be compounded by salvage activities. This analysis will measure the degree to which the alternatives considered effect wildlife habitat.

The key indicators for big-game habitat include: 1) forage/hiding/thermal cover ratio; and 2) habitat quality index (HQI), a description of habitat quality in terms of distribution and size of forage and cover areas, forage quality, cover quality, and disturbance by road traffic.

The key indicator for old-growth-dependent species is: 1) suitable habitat for northern spotted owls, pileated woodpeckers, and pine marten.

The key indicator for interior species habitat is interior habitat index (IHI), a measure of the relative ability of forest stands to provide this habitat. The size, inter-connectiveness, and degree of fragmentation of forest stands determine how much of this habitat is degraded by openings in the forest. Such openings cause increases in light, wind, snow accumulation, and temperature fluctuations within interior forest stands. Some interior forest species are the red-backed tree vole, northern flying squirrel and the Oregon slender salamander.

The key indicator for species dependent on dead and decaying tree habitat is suitable habitat for primary cavity excavators such as woodpeckers. For example, the pileated woodpecker requires tall and large diameter trees with heart rot for nesting.

The key indicator for species dependent on riparian areas is acres of riparian habitat impacted. For example, tailed frogs and Olympic salamanders require the riparian area associated with cool, clean, rocky streams. A variety of mammals, birds and invertebrates, as well as other amphibians, require the microclimate and habitat type offered by riparian areas.

The key indicators for threatened, endangered, and sensitive species are potential nesting sites and acres of suitable structural habitat for the bald eagle, potential habitat for threatened and endangered plant species, and potential habitat for peregrine falcons, western pond turtle, and Oregon chub.

5. VISUALS/RECREATION: The visual resource is valuable to the extent that it affects the quality of the recreation experience. The major concern about visuals/recreation in the planning area is the effect of the fire on the visual resource as viewed from Hills Creek Reservoir, adjacent campgrounds, and Forest Service Road 21. This analysis will measure the degree to which the alternatives considered effect the visual resource.

Two key indicators are used to express changes in the visual setting for each alternative: 1) harvest rate per decade; and 2) recovery rate of vegetation (years).

6. SOCIAL/ECONOMICS: The issue is the ability of the alternatives to efficiently provide a positive present net value (PNV) and contribute revenues to the Federal treasury, county roads, and public school budgets.

The key indicators used to measure the economic consequences of alternatives are: 1) economic efficiency - a) net benefits and b) present net value (PNV); and 2) economic and social impacts - a) revenues to county roads and public school budgets, and b) jobs and wage income.

FEIS ORGANIZATION

Chapter I, Purpose and Need, describes the purpose and need for this project as well as the purpose of this EIS. In addition, this Chapter gives a brief overview of the analysis area and introduces the issues, concerns, and opportunities relating to the proposed action.

Chapter II of this document identifies alternative ways of addressing or resolving the recovery issues. A range of alternatives, including the alternative of no action, are considered that would produce varying mixes of goods and services and forest resource conditions. The alternatives are presented in a format which allows comparison of environmental effects and how well they respond to each of the identified issues. Mitigation measures which would avoid or reduce environmental impacts are also proposed. The preferred alternative is identified.

Chapter III, The Affected Environment, describes the land and resources as they exist after the fire but prior to management activities. The environmental conditions, which will be affected by or will affect the proposed activities, are discussed in this Chapter.

Chapter IV, Environmental Consequences, includes physical, biological, social, and economic impacts on the land and associated resources resulting from each alternative. Effects are measured in terms of the key indicators developed for each of the major issues. Each issue analysis addresses the following for each alternative: direct, indirect, and cumulative effects on the affected environment; measures taken to mitigate these effects; the relationship between short-term uses of the human environment and long-term maintenance of productivity; irreversible and irretrievable commitments of resources; adverse impacts which cannot be avoided; and potential conflicts with other plans and policies. Particular attention is given to cumulative effects (the incremental impact of combinations of activities over time). This Chapter forms the scientific and analytic basis for comparison of alternatives.

Chapter V, Public Participation is an account of public reaction to the DEIS. It contains letters submitted by public agencies and a summary of comments from individuals and organizations. Comments are followed by responses from members of the Shady Beach Recovery Project Planning Team.

A list of preparers includes names and qualifications of persons primarily responsible for producing this document.

A glossary defining terms is located after the last Chapter. Acronyms and abbreviations are defined at first mention in the text as well as in the glossary. Most terms are defined only in the glossary to avoid excessive interruption of the text. A list of literature cited in the EIS is also provided. Readers will find it helpful to consult maps showing the management direction proposed for each alternative.

Appendices A through G include analytical reports, figures, and data which help to substantiate the analysis results. Appendices consist of technical materials prepared in connection with this EIS.

The following documents are incorporated by reference into this EIS and are available for viewing at the Rigdon Ranger District, Willamette National Forest, 49098 Salmon Creek Road, Oakridge, Oregon 97463, (503) 782-2283.

1. The Final Environmental Statement, Multiple-Use Land Management, Willamette National Forest, 1977

2. The Proposed Land and Resource Management Plan and Draft Environmental Impact Statement for the Willamette National Forest, 1987.

3. General Water Quality Best Management Practices, USDA Forest Service, Pacific Northwest Region, Portland, Oregon, 1988.

4. Appendix C, Site Productivity Report of the Final Environmental Impact Statement, Silver Fire Recovery Project, USDA Forest Service, Siskiyou National Forest, 1988.

5. Shady Beach Fire Recovery Project Analysis Files, a collection of supporting documents and records of the analysis process, 1989.

ALTERNATIVES, INCLUDING THE PROPOSED ACTION

INTRODUCTION

The purpose and need for action were discussed in Chapter I. Chapter II describes alternative actions for meeting this purpose and need through implementing fire recovery projects, salvaging fire-killed or damaged timber, and reforesting fire-damaged lands. Taking no action is also considered and described.

The alternatives were developed by the Interdisciplinary (ID) Team assembled for this project. This group of specialists has expertise in the various resources related to the issues presented in Chapter I. These issues are Soils, Water Quality/Fish Habitat, Timber, Wildlife Habitat/Old-Growth, Visuals/Recreation, and Social/Economic. They were developed through the scoping process required by the National Environmental Policy Act (NEPA). The range of alternatives included a Maximum Timber Salvage Alternative and a No Action Alternative. These provided sideboards from which all other alternatives were developed. Chapter II also evaluates these alternatives, presents a preferred alternative, and is intended to provide the public and the decision-maker with a clear basis for choice.

This Chapter contains sections on: 1) Alternative Development Process, 2) Description of the Analysis Process, 3) Alternatives Eliminated from Detailed Study, 4) Alternatives Considered in Detail and Identification of the Preferred Alternative, and 5) Comparison of Alternatives. Use this Chapter to become familiar with the various alternatives being considered. It should give you a feel for each alternative proposal for salvaging damaged timber, enhancing resource conditions, and mitigating adverse impacts resulting from both the fire and proposed salvage operations. The last this Chapter will help you key in on how the environmental effects differ between alternatives.

ALTERNATIVE DEVELOPMENT PROCESS

Alternatives were developed through an issue-driven process designed to address both Forest Service and public concerns. This process provided a range of alternative choices for managing resources within the fire recovery area.

The Scoping Process was started in September with a concerted effort to seek comments and concerns about the fire area. The various concerns were identified, consolidated, and categorized in late October. Concerns were reviewed and assembled as issues and key indicators on October 26. The Oregon Department of Environmental Quality (ODEQ) and the Environmental Protection Agency (EPA) participated at the request of the Forest Service.

On November 4, four representatives of the wood products industry, the environmental community, and the Oregon Department of Fish and Wildlife (ODFW) were invited to be ID Team members. They were chosen as spokespersons for their respective constituencies and for their demonstrated interest in the analysis process. This was done to increase public involvement and to insure that alternatives would be developed and examined from many viewpoints.

On November 21, the Project Team and Board of Directors met and developed a strategy for developing alternatives. This strategy defined the full reasonable range for which all alternatives would be developed. The alternatives would range from a No Action Alternative to a Maximum Timber Salvage Alternative with an intermediate range of alternatives. These intermediate alternatives would then be developed to test the effects of various management scenarios.

The first alternatives to be addressed were the No Action and the Maximum Timber Salvage Alternatives. The No Action Alternative was fully developed and analyzed. The Maximum Timber Salvage Alternative was considered but not fully analyzed because it did not meet several legally mandated resource concerns and because there was public opposition to this alternative form both industry and the environmental community.

On December 2, the Board of Directors and the group leaders initiated concepts for alternatives that were used by the ID Team to design the first array of alternatives. (The Board of Directors and group leaders are listed in the List of Preparers section of this document.) Three days later, the Board of Directors met with the team leaders to refine these alternatives. A new alternative was added which emphasized soils and water protection. This was subsequently changed to include wildlife habitat management.

On December 8, an alternative design workshop was held for the public in Eugene, Oregon. The workshop was attended by approximately 60 participants representing a variety of interests. In addition, Ranger District and ID Team workshops were conducted the same week. The participants were given the opportunity to brainstorm intermediate alternative themes responding to the issues. Related themes were then combined by the groups. Comments were also made on the proposed minimum and maximum alternatives. There was opposition to the suggestion that the Forest Service would consider a maximum unconstrained timber harvest alternative. This was expressed by several individuals from the wood products industry who felt that such an alternative would give the industry bad publicity.

On December 9, the ID Team met to assimilate all the themes generated at the workshops. When all the refinements were made, there were four intermediate alternatives that represented the range between the No Action and Maximum Timber Salvage alternatives.

On December 12, the Willamette National Forest Supervisor and Staff met with the Board of Directors and project group leaders to refine the alternatives, assure responsiveness to the issues, and to assure that a full range of reasonable possibilities had been addressed.

DESCRIPTION OF THE ANALYSIS PROCESS

The analysis process started in early November with field data collection and verification and ran concurrently with the alternative development process. Specialists compiled their baseline data to be used for later comparison. The actual analysis occurred later in December and January as each alternative was developed and the individual salvage harvest units were identified.

The analysis was done to determine the effects of both the proposed management activities and the fire on the environment. The combined effects were then compared by alternative. The key indicators developed during scoping were used to measure effects on the identified issues.

A Geographic Information System (GIS) was the primary system used for analysis. GIS is a computer-based, multi-resource database system that organizes data spatially in individual resource layers composed of lines, points, and polygons. GIS has the ability to supply information based on individual layers or on intersecting features when different resource layers are overlaid. This ability to overlay databases for different resource layers assisted an interdisciplinary and site-specific analytical approach.

The intermediate alternatives were analyzed in order of projected timber harvest volumes from high to low for efficiency of using the same information and applying different and increasing emphases on other resources. Each alternative was analyzed for its effect on the issues and for displaying variations from the baseline conditions. New ideas generated from information received during the public comment period resulted in changes between the DEIS and this final environmental impact statement.

ALTERNATIVES CONSIDERED BUT NOT GIVEN DETAILED STUDY

Several alternatives generated during the initial alternative strategy meetings were not fully developed because they were not feasible or because they were similar to other alternatives. Two other alternatives - the No Change and Maximum Timber Salvage alternatives were considered but were dropped from further analysis. These are presented here along with the rationale for dropping them from further analysis.

NO CHANGE

The No Change Alternative would ignore the effects of the Shady Beach fire, and the management of the analysis area would continue as scheduled in the Rigdon Ranger District's 10-year, timber-sale schedule.

This alternative was dropped from consideration because continuing business as usual would not be a viable option. Timber sales planned before the fire would not be viable as they have been changed by the fire. In addition, environmental conditions have changed, resulting in a need to analyze and redesign timber sales to respond to post-fire resource conditions.

ALTERNATIVE A

This alternative was developed with few management considerations given to other resources or adverse impact mitigation in order to provide an upper bound for alternative development. This alternative's effects were fully assessed for timber volume, economics, and stream temperature. Other evaluation factors were qualitatively compared to the fully analyzed alternatives.

This alternative would provide the maximum timber sale volume by harvesting all dead and incidental green trees necessary to make logical and efficient harvest units. Soils, water, wildlife, and visuals would be de-emphasized in order to maximize the timber volume harvested. In this alternative, 195 million board feet (gross merchantable volume) would be harvested and 30.3 miles of road would be constructed.

Based on research data and modeling assumptions, this alternative would cause the largest amount of surface-soil erosion, site-productivity loss, and reduction in water quality and fish habitat. It would produce the largest timber harvest and growth among the various alternatives considered. It would also cause the greatest decrease in old-growth, interior species, and edge species habitat.

Elements of Alternative A would include the following: All dead and damaged trees, as well as those merchantable trees expected to die within 1 year, would be harvested. Where harvesting of dead and predicted mortality trees would leave the residual stand in an understocked condition, the salvage prescription would be changed to regeneration harvest where stands would be clearcut and replanted. All incidental green timber would be harvested for efficient timber management. All areas which would be regeneration cut and fire-damaged plantations would be planted with tree seedlings. Partially cut harvest units would not be planted. The road system would be fully developed to maximize the use of conventional cable yarding systems.

The economic projections of this alternative are as follows:

Economic Efficiency	
Net Benefits 1989-1990	$48.8 million
Present Net Value 1989-2039	$117.5 million
Economic and Social Impacts 1989-1990	
County Revenues	$13.0 million
Jobs (number, direct)	1,112
Wage Income	$22.8 million

This alternative was eliminated from further study for the following reasons: 1) Analysis of the effects on stream temperature showed that the alternative would have an adverse impact on the fisheries resource. Six of the nine drainages with fisheries potential were predicted to show a measurable increase in temperatures as compared with post-fire temperatures. The anticipated cumulative effect on Hills Creek would be a measurable temperature increase (0.5 degrees F) as compared to post-fire temperatures; 2) The effects on wildlife would be contrary to existing legislation and/or Forest Service policy; 3) Recovery would have been delayed because Alternative A did not meet legal requirements or Forest Service policies and direction and would have required legislation to enact; 4) Further review showed that if Alternative A was altered to a point that reduced these impacts to a minimally acceptable level, it would then be equivalent to Alternative B; and 5) This alternative was strongly criticized when presented at the Eugene public meeting. No group or individuals advocated maintaining this alternative for full analysis.

ALTERNATIVES CONSIDERED IN DETAIL

Five alternatives were considered in detail, including the No Action Alternative. This section presents features common to various alternatives and specific alternative descriptions. Both mitigation and enhancement activities are described.

FEATURES COMMON TO ALL ALTERNATIVES

This section contains activities and elements common to all alternatives. The direction for these overall treatments came from Forest Service National, Regional, and Forest policies, standards, and guidelines.

1. For rehabilitation in the fire area approximately 700 acres of land with severe erosion potential, primarily drainage headwalls, and 92 acres of riparian areas were seeded to grass to minimize soil erosion. In addition, 28 miles of fire line were water-barred, and 25 of those

miles were seeded with grass during the fire mop-up efforts to minimize erosion, log booms, culvert clean out with graters, ditches pulled, and winter maintenance on winter roads.

2. All regeneration harvested areas and plantations damaged by the fire would be planted with trees.

3. An opportunity exists to provide information to the public about the effects of wildfire, fire prevention, management of the area, and recovery of resources. An information plan is being developed by Rigdon Ranger District, and may include signs, viewpoints, self-guided tours, and ways to reach out to schools and groups.

FEATURES COMMON TO ALTERNATIVES B, C, D, AND F

1. Activities would comply with The National Forest Management Act (NFMA) (U.S. Congress l976) requirements for site reforestation within 5 years and with the executive orders specifying wetland and flood plain protection.

2. Unless a resource opportunity is identified, only those harvest units that provide a positive net return to the Government would be removed, and only those roads which would produce a positive economic return over the life of the road would be constructed.

3. The General Water Quality Best Management Practices of Region 6 (USDA Forest Service 1988g) applicable to proposed actions such as road construction, stand establishment, and timber harvesting, would be practiced in each alternative.

RESOURCE IMPACT MITIGATION AND ENHANCEMENT

Resource impact mitigation and resource enhancement would occur for all fully analyzed action alternatives. They were designed to reduce negative impacts of the alternative actions as well as to enhance resource conditions impacted by the fire. The degree to which they are implemented would depend upon the anticipated cumulative effects of the fire, past and proposed management activities, and the goals and objectives of each alternative. These mitigating actions were designed to meet or exceed state and legal standards and management direction and policy. All action alternatives include provisions for protecting threatened and endangered species habitat, water quality, soil productivity, unstable lands, riparian habitat, and cultural resources. Specific detailed descriptions of mitigation prescriptions are located in the Shady Beach Recovery Project Analysis Files.

Mitigations and Enhancements Common to Alternatives B, C, D, and F

1. To provide long-term organic matter for the soil all unmerchantable material (logs containing less than 50 percent chippable material and/or are less than 8 inches in diameter and 12 feet long) would be left on the site.

2. Areas affected by timber-harvesting activities would be evaluated following the completion of harvesting operations for additional erosion-control measures.

3. Special design considerations would be given when constructing roads in potentially high soil-surface erosion and mass-wasting areas to reduce stream channel sedimentation. These considerations include, but are not limited to, road location, road drainage design, and special vegetative and mulching practices.

4. Erosion control structures would be constructed to reduce the amount of sediment reaching stream channels within high-intensity burn areas that have a high or very high erosion class (as identified in the Soil Resource Inventory). Structure placement will occur depending on site-specific conditions as identified by watershed specialists.

5. Hardwoods (eg. willow and alder) would be planted along selected Class II, III, and IV streams which received a moderate- to high-intensity burn to minimize stream temperature increases, reduce sediment and turbidity, and protect fisheries habitat.

6. Trees, suitable as large woody debris (Vanderhayden 1984) when placed into selected Class II, III, and Class IV streams in moderate- and high-intensity burn areas, would be felled into the stream to improve channel stability, to trap sediment, and to enhance fisheries habitat. This would be done inside and outside of harvest units where field surveys indicate that there is insufficient material present in the streams or at approximately every 300 feet. The tree would be bucked into appropriate lengths and the pieces placed for maximum benefit. Additional material would not be placed if material is already in the stream and is providing the desired benefits and where adequate material is not on site.

7. Cut banks and fill slopes of selected roads and temporary spurs that will be permanently closed will be mulched, grass-seeded, and fertilized to reduce the amount of sediment-reaching stream channels.

8. Harvest activities would be restricted within 660 feet of occupied osprey nest sites from March 1 to August 31.

9. In addition to harvest restrictions within the Bull Creek bald eagle management area (BEMA), bald eagle perch trees would be identified and retained near the reservoir and along Hills Creek.

10. Selected areas within the fire area will receive a high-protein grass seed mixture compatible with conifer seedling survival and growth to mitigate lack of adequate big-game thermal cover. Big-game forage quality will be enhanced minimizing the effect of a loss in thermal cover due to fire effects and salvage harvest activities.

11. Selected roads would be closed to vehicle traffic after harvest activities have been completed in accordance with Rigdon Ranger District 1988 road closure policy (guidelines for this policy are developed using an interdisciplinary, systematic evaluation of various multiple-use objectives in areas considering road closures). This would be done to reduce big-game harassment due to loss of hiding cover near forage areas, to minimize road damage during periods of wet weather, and to reduce stream sedimentation.

12. The safety of forest travelers during logging operations is an important objective. Logging traffic within the fire area and on roads along the reservoir will increase dramatically during salvage operations. All collector and local roads will be closed to public travel during harvest operations (36 CFR 261.50(b), (e) and 261.54(e)). In addition, a traffic management plan is being developed with input from the State, Lane County, City of Oakridge, and timber industry representatives. Safety measures address hazards such as speed, traffic at junctions and recreation sites, traffic within the fire area, etc. The public will be notified of specific measures through the media, signs, and personal contacts.

13. Prior to ground-disturbing activities, a survey would be conducted to evaluate occurrence of threatened, endangered, and sensitive plant species. If populations are found, mitigating actions would be taken to assure that management activities would not jeopardize the continued existence of these species or result in an adverse modification to their essential habitat. Such modifications might include shifting of road locations, directional falling away from special habitat areas, full log suspension over these areas, and retention of buffers where appropriate.

14. The two undisturbed archeological sites would be impacted by road construction and/or timber harvest. The sites will be evaluated for significance and mitigated if found significant and eligible for the National Register of Historic Places. The evaluation and mitigation will include excavation of a portion of the sites with analysis and documentation of generated information. The evaluation and mitigation will occur prior to any construction of harvest activities.

Mitigations and Enhancements Common to Alternatives C, D, and F

1. Class I, II, and III streams (see Glossary for definition of stream classes) would have a designated 75- to 150-foot-wide streamside management unit (SMU) on each side of the stream to protect water quality and riparian habitat. Beginning on each side of the high water line, no timber harvesting would be allowed within a minimum horizontal distance of 75 feet from the stream. Dead timber would be left in the harvest-restricted SMUs regardless of harvest-unit prescriptions. Corridors of minimum width and number for road construction and cable logging on adjacent lands would be exceptions to the restricted harvest area.

2. A streamside zone would be designated along sensitive Class IV streams to protect the stream courses and associated resources. Within these streamside areas, various mitigating activities would occur such as directional falling, full suspension of logs, retention of non-merchantable vegetation, stream channel clean out, placement of large woody debris, and/or planting of stabilizing vegetation, depending upon site-specific conditions as identified by watershed specialists.

   Selected Class IV streams adjacent to areas of high mass-wasting potential or in unstable stream beds would have no harvest within a minimum of 50 feet from the stream channel edge to protect water quality. Dead timber would be retained in the harvest-restricted streamside areas regardless of harvest prescription.

3. Trees felled for cable logging corridors within harvest-restricted SMUs would not be removed. These trees would provide large woody debris (LWD).

4. From 8 to 15 unmerchantable logs would be left scattered on each acre to maintain the sites' nutrient reserves and to maintain small mammal and amphibian habitat. These logs would be at least 16 inches in diameter and at least 8 feet long.

5. A buffer will be left around special habitats. An inventory of areas with potential for occupancy by sensitive species will be conducted prior to ground-disturbing activities for identification of special habitat. A buffer will be established if a special habitat is identified, based upon the occurrence of sensitive species or unique plant or animal communities.

Mitigations and Enhancements Common to Alternatives C and D

1. Snags and replacement trees would be retained as wildlife habitat. Trees to be retained will be greater than 18 inches in diameter and at least 60 feet tall. The objective would be to maintain a minimum of 40 percent of the potential population capacity of primary cavity excavators (woodpeckers). An average of 1.55 snags per acre would be retained in harvest units. In timber harvest units that contain green trees, an additional 1.8 green trees would be retained to provide replacement snags in the future. In partial cut areas, natural mortality of the green trees retained would be expected to provide replacement snags. Concentrating snags in patches within harvest areas would be desired to increase their chance of surviving logging operations. These patches would be distributed throughout the harvest areas. Often trees which have been designated to be retained for wildlife have to be felled in order to meet logging safety needs. An assessment would be made of the snags remaining following log-yarding operations. In the event that the remaining snag population falls below desired levels, the tops would be removed from the green trees that were retained as future replacement snags.

2. No timber harvesting would be allowed at any time within 330 feet of a northern spotted owl nest site and seasonal restriction will be applied to a 660 foot radius around the site.

3. Alternatives C and D provide for 8 to 15 firm logs of Decay Class I, II or III per acre (Figure IV-46) on harvest areas to be left for those species (salamanders, rodents, reptiles) that use deteriorated log habitat. The prescribed diameter is at least 16 inches or greater at the large end, and the prescribed length is 8 feet or more.

Mitigations and Enhancements for Alternative B

1. A 75-foot-wide SMU would apply to all Class I, II, and III streams. Within this area, 75 percent of the timber volume would be harvested. The remaining 25 percent of the timber volume would be composed of green trees if available.

2. Snags would be retained as wildlife habitat. The objective would be to maintain a minimum of 40 percent of the potential population capacity of primary cavity excavators (woodpeckers). An average of 1.55 snags per acre would be retained in harvest units. No replacement trees would be retained.

3. Alternative B provides for two firm logs per acre on harvest acres to be left for those species (salamanders, rodents, reptiles) that use deteriorated log habitat. The prescribed diameter is at least 12 to 17 inches at the large end, and the prescribed length is 20 feet or more.

4. No timber harvesting would be allowed at any time within 330 feet of a northern spotted owl nest tree.

Mitigations and Enhancements for Alternative F

1. Snags and replacement trees would be retained as wildlife habitat. The objective would be to maintain 100 percent of the potential population capacity of primary cavity excavators (woodpeckers). An average of 7.5 snags per acre would be retained in harvest units. One-half would be existing snags and one-half green trees to provide replacement snags in the future. These trees would not be evenly distributed (many existing plantations do not meet this standard). Snags and replacement trees would be more concentrated in SMUs and specially designated areas, as well as harvest areas. Concentrating snags in patches would be desired in clearcut harvest areas to increase their chance of surviving logging operations.

2. Alternative F would provide for leaving 8 to 15 firm logs of Decay Class I, II or III (Figure IV-44) per acre on harvest areas. By providing existing snags in addition to leaving green trees for future snags, down logs will be in excess of the 8 to 15 per acre in Years 40 to 60. The log diameter size would be 36 inches or larger on the large end and 20 feet or more in length to provide long-term, moist log habitat.

3. No timber harvesting would occur within a 60-acre area containing a northern spotted owl nest site.

MONITORING

Numerous resources within the project area will be monitored to determine the effects of the fire, management activities, and mitigation and enhancement measures. A monitoring plan for each specific project has been developed, and can be obtained by contacting the Rigdon Ranger District, Oakridge, Oregon.

Monitoring Activities Common to Alternatives B, C, D, and F

1. A position will be created to monitor the salvage and recovery activities to insure that the objectives of the FEIS are achieved. KV funds will be collected from timber sale contract receipts to pay the salary for this position. Rigdon Ranger District will ensure management (District Ranger and Forest Supervisor) receives frequent, regular written updates on the progress of monitoring and results. Information will be shared with interested publics and agencies.

2. The Bull Creek area would be monitored to determine its suitability and occupancy for northern spotted owls for a minimum of 5 years.

3. The burned area along Hills Creek Reservoir and the Bull Creek bald eagle management area (BEMA) would be monitored during the bald eagle nesting season to determine bald eagle use.

4. In cooperation with the Oregon Department of Fish and Wildlife and the U.S. Forest Service a big-game forage enhancement project will be implemented. Under this agreement, selected areas within the fire will receive a high-protein grass seed mixture compatible with conifer seedling survival and growth. Forage utilization and grass mixture compatibility with tree seedling survival and growth will be monitored.

5. Surveys will be made of potential habitats within the analysis area for possible occurrence of threatened, endangered and sensitive species. If a threatened or endangered species is located within the analysis area, proposed activities will be delayed until a biological assessment is made and followed with consultation with the U.S. Fish and Wildlife Service. If sensitive species are located mitigation measures will be recommended to eliminate or reduce adverse effects of proposed activities.

6. Monitoring of critical streams is in place to measure, record, and evaluate Best Management Practices (BMP) as they relate to suspended sediment, turbidity, stream flows, and temperatures.

7. An opportunity exists to evaluate and describe vegetation recovery following the Shady Beach Fire. Permanent monitoring sites are established for the long-term study of fire effects on native and interim species, and wildlife habitat (snags and forage). The reliability of mortality predictions used in this EIS will also be assessed.

8. A regeneration study will be installed in areas with harsh aspects and shallow rocky soils to study regeneration success. A variety of harvest prescriptions (partial cutting, shelterwood, and seed tree) and regeneration techniques will be used while studying reforestation success upon these soil types.

ALTERNATIVE DESCRIPTIONS

Alternative E No Action, Environmentally Preferable

No programmed timber harvest would occur. Recovery in the unmanaged portions of the fire area would be the result of natural processes. Incidental tree removal would occur for public safety and to prevent immediate resource damage. Rehabilitation activities would occur when necessary to prevent or correct immediate resource damage. Artificial reforestation would occur only in plantations damaged by the fire.

This alternative has been identified as one of two alternatives, both which are environmentally preferable. Environmentally preferable refers to the alternative(s) that causes the least damage to the biological and physical environment; it also means the alternative(s) which best protects, preserves, and enhances historic, cultural, and natural resources.

Alternative B

A total of 166 million board feet of gross merchantable timber volume would be harvested on 4,695 acres and, 21.2 miles of roads would be constructed. Dead, damaged, and incidental green trees would be salvaged under this alternative while meeting the resource objectives listed below. These objectives meet the 1977 Willamette National Forest Land Management Plan (Current Forest Plan/FEIS) and interim Regional and Forest direction where they have not already been compromised by effects of the fire.

For detailed, specific information on harvest areas, see Appendix G and the Alternative maps. Appendix G lists area size, harvest prescription, harvest method, and volume of dead and green timber harvested for each harvest area.

Water Quality/Fish Habitat: Streamside management unit (SMU) buffer widths and timber yields from SMUs would comply with the Current Forest Plan/FEIS. Some vegetation for stream shading and stream bank stability would be maintained and/or re-established in riparian areas.

Timber: All dead trees would be harvested with the exception of those left for wildlife habitat. The remaining green trees in a fire-damaged stand would be harvested when the stocking condition is insufficient to attain a 70 percent crown closure within 15 years. Stands in this condition would not provide 100 percent recovery for aggregate recovery percentage (ARP) (see Glossary) and wildlife thermal cover within 15 years. Incidental green trees would be harvested, when necessary, for the efficient and logical harvest unit boundaries. The road system would be fully developed to maximize the use of conventional cable logging systems except in some areas where scenic quality is emphasized. Dead and incidental green trees on lands unsuited for intensive timber management would be harvested. Dead trees on unstable soils would be harvested where they no longer contribute to slope stability.

Wildlife Habitat: The bald eagle management area (BEMA) would be retained but there would be no designations for the pine marten habitat area (PMHA), pileated woodpecker habitat area (PWHA), or spotted owl habitat area (SOHA). Management of big-game forage and cover ratios, wildlife trees, and sensitive plants would adhere to Regional and Forest direction as specified in the Current Forest Plan/FEIS.

Alternative C Preferred Alternative

A total of 144 million board feet of gross merchantable volume would be harvested on 4,623 acres and, 18.1 miles of roads would be constructed. Timber would be harvested to the full extent possible while meeting the following resource objectives where they have not already been compromised by effects of the fire. These objectives follow the standards and guidelines in the Proposed Forest Plan/DEIS.

For detailed, specific information on harvest areas, see Appendix G and the Alternative maps. Appendix G lists area size, harvest prescription, harvest method, and volume of dead and green timber harvested for each harvest area.

Water Quality/Fish Habitat: Streamside management units would be retained to mitigate timber harvest effects. Objectives would include retaining shade in riparian areas, providing for large woody debris, and minimizing erosion-causing activities.

Timber: All dead trees would be harvested, except for specific areas where harvest would be restricted to meet other resource objectives. Green trees in fire-damaged stands would also be harvested when stocking condition is insufficient to attain 70-percent crown closure within 15 years. Incidental green trees would also be harvested when necessary for logical and efficient harvest unit boundary locations and where required for skyline anchors and corridors. Conventional yarding systems would be used by fully developing the road system except within the Middle Fork viewshed where some roads of high visual impact would not be constructed.

Wildlife Habitat: Management direction in the Current Forest Plan/FEIS and in the interim Forest direction would be met. The bald eagle management area would be retained. There would be no SOHA or PMHA designation in the lower elevations. The PMHA at Shady Gap would be retained. The PWHA at Shady Gap would be eliminated as it no longer meets minimum habitat requirements due to the fire. The PWHA in the Bull Creek area would be retained.

Alternative D

A total of 133 million board feet gross merchantable volume would be removed on 4,702 acres, there would be no new road construction. Resource protection and enhancement would be provided for all resources affected by the fire as outlined in the objectives below. This alternative would attempt to meet or surpass the standards and guidelines in the Proposed Forest Plan/DEIS where they have not already been compromised by effects of the fire.

For detailed, specific information on harvest areas, see Appendix G and the Alternative maps. Appendix G lists area size, harvest prescription, harvest method, and volume of dead and green timber harvested for each harvest area.

Water Quality/Fish Habitat: Streamside management units would be retained to mitigate timber harvest effects. Objectives would include retaining shade in riparian areas, providing for large woody debris, and minimizing erosion-causing activities.

Timber: Only dead trees would be harvested. Green trees would be harvested where required for skyline anchors and corridors as well as those trees that might pose a safety hazard. No incidental green trees would be harvested to provide for logical and efficient unit boundary locations. Use of the existing road system and aerial logging systems would be emphasized since no new roads would be constructed.

Wildlife Habitat: Management direction in the Current Forest Plan/FEIS and in the interim Forest direction would be met. The bald eagle management area would be retained. There would be no SOHA or PMHA designation in the lower elevations. The PMHA at Shady Gap would be retained. The PWHA at Shady Gap would be eliminated as it no longer meets minimum habitat requirements due to the fire. The PWHA in the Bull Creek area would be retained.

Alternative F Environmentally Preferable

Salvaging fire-killed timber would be subordinate to protecting and enhancing wildlife habitat, water quality, and soil resources. A total of 96 million board feet of gross merchantable volume would be harvested on 2,566 acres, 11.2 miles of road would be constructed. This alternative would not meet Proposed Forest Plan/DEIS standards and guidelines for timber management. In all other respects this alternative would meet or surpass the standards and guidelines where they have not already been compromised by effects of the fire.

For detailed, specific information on harvest areas, see Appendix G and the Alternative maps. Appendix G lists area size, harvest prescription, harvest method, and volume of dead and green timber harvested for each harvest area.

This alternative has been identified as one of two alternatives, both which are environmentally preferable. Environmentally preferable refers to the alternative(s) that causes the least damage to the biological and physical environment; it also means the alternative(s) which best protects, preserves, and enhances historic, cultural, and natural resources.

Soils: Salvage activities on highly sensitive soils would be limited. Organic matter on the ground would be retained as much as possible including large material for long-term availability (see mitigations).

Water Quality/Fish Habitat: This alternative would develop streamside management units (SMUs) to mitigate harvest effects, enhance shade in riparian areas, provide for large woody debris in streams, enhance the ability of riparian areas to trap and retain sediment, minimize erosion-causing activities throughout the fire area, bring the aggregate recovery percentage up to 75 percent as quickly as possible, and aggressively provide ground cover in fire and harvest areas to minimize erosion.

Timber: Dead and green timber volume would be harvested only where it would not have measurable adverse impacts on wildlife, soil, and water quality. No green trees would be harvested in areas of high mass-wasting potential or at the confluence of streams. The remaining green trees in fire-damaged stands would be harvested if the long-term benefits to wildlife, soils, and water quality would be enhanced. Incidental green trees could be harvested where necessary to maintain logical unit boundaries. The existing road system would be emphasized but new construction may occur.

Wildlife Habitat: Management Requirements (MR) presented in the Proposed Forest Plan/DEIS and the interim Forest direction would be met. These include: 1) retaining the bald eagle management area (BEMA) and perching habitat near the reservoir, 2) retaining the PWHA and three PMHAs, and 3) maintaining primary cavity-nesting and log habitat. Management objectives would also include enhancing big-game forage/hiding/thermal cover ratios and maintaining the Bull Creek SOHA at 1,500 acres, of which 529 would be designated for enhancement. Due to the effects of the fire, this SOHA does not meet minimum habitat requirements as defined in the Final Supplement to the EIS for an Amendment to the Pacific Northwest Regional Guide, Volume 1, Spotted Owl Guidelines (USDA Forest Service 1988f). It would be expected to meet minimum requirements in 80 to 120 years.

COMPARISON OF ALTERNATIVES

Estimated environmental effects for each alternative are summarized in Figure II-1 and followed by a discussion of significant differences among alternatives. Environmental effects are more fully displayed and discussed in Chapter IV.

ALTERNATIVE COMPARISON BY ISSUE

SOILS

INDICATOR	B	C	D	F	E
Total Organic Material* (tons/acre) in fire area	206	216	222	245	291
Total Erosion Rate* 1) (cu.yds/acre/yr) in analysis area	1.20	1.19	1.15	1.17	1.14

1) Combination mass-wasting potential and surface soil erosion
* Key Indicator

WATER QUALITY / FISH HABITAT

INDICATOR	B	C	D	F	E
STREAMS					
---mean maximum temperature* 1) (degrees F)	57.9	57.5	57.5	57.4	57.4
---Erosion Index (cu.yds/yr)	2600	2570	2470	2520	2460
---aggregate recovery percent(ARP)* 2)	44	45	46	47	48
---impacts on potential long-term recruitment of LWD* 3)	H	M	M	L	L
RESERVOIR					
---water temperature* 3)	L	L	L	L	L
---increased turbidity*	<2%	<2%	<1%	<1%	4%
---increased sediment delivered (cu.yds/yr)*	900	878	796	832	779

Values include reductions for mitigation
1) Average of most Class II and III streams during August (weighted by flow)
2) Weighted average of subdrainages for the analysis area
3) LWD = Large Woody Debris, L=Low, M=Moderate, H=High
* Key Indicator

Figure II-1 Alternative comparison by issue

ALTERNATIVE COMPARISON BY ISSUE

TIMBER

INDICATOR	B	C	D	F	E
Volume Harvested (MMBF) (gross merch. volume) 1989-1990					
—dead & potentially dead*	141	130	133	91	0
—green*	25	14	0	5	0
—Total	166	144	133	96	0
Mortality Not Harvested (MMBF) (gross merch. volume)	13	18	15	57	148
Area Harvested by Silvicultural Prescription (acres)					
—partial cut	1694	2063	2713	579	
—regeneration cut					
........clearcut	2806	2372	1891	1920	0
........shelterwood	195	188	98	67	0
Total Regeneration Cut	3001	2560	1989	1987	0
Total Acres Harvested	4695	4623	4702	2566	0
Unsuitable Timber Land Harvested* (acres)	195	171	137	156	0
Timber Volume Growth Loss* (MMBF) 1989-2069	129	142	172	246	843
Harvest System (acres)					
—cable					
........highlead	96	112	101	93	0
........skyline	4101	3934	2120	2171	0
—helicopter	495	563	2481	302	0
Area Reforested (acres) 1)	4611	4184	3628	3645	1795
Road Construction (miles)	21.2	18.1	0	11.2	0

1) Includes Existing Plantations
* Key Indicator

Figure II-1 Alternative comparison by issue

ALTERNATIVE COMPARISON BY ISSUE

WILDLIFE HABITAT

INDICATOR	B	C	D	F	E
BIG-GAME					
—forage/hiding/thermal cover* (ratio) 1)	74-9-17	72-11-17	62-19-19	62-11-27	59-11-30
—Habitat Quality Index* (HQI) 2)					
........Year 0	0.57	0.56	0.55	0.59	0.61
........Year 9	0.51	0.53	0.49	0.55	0.54
........Year 22	0.35	0.36	0.35	0.38	0.39
OLD-GROWTH DEPENDENT SPECIES					
—Designated Habitat (acres)					
........Northern Spotted Owl*	0	0	0	1500	0
........Pileated Woodpecker*	0	300	300	300	300
........Pine Marten*	0	160	160	480	160
INTERIOR HABITAT INDEX* (IHI) 2)	0.40	0.40	0.40	0.41	0.41
........# of Habitat Patches	13	13	13	16	16
........available habitat (acres)	4222	4222	4251	5660	5701
DEAD AND DEFECTIVE TREE HABITAT					
Primary Cavity Excavator Species					
% pop. capacity Year 0	46.2	49.6	51.9	69.2	69.2
% pop. capacity Year 30	39.6	47.7	46.2	52.9	52.9
THREATENED, ENDANGERED, & SENSITIVE SPECIES					
—Suitable Habitat (acres)					
........Bald Eagle Potential Nest Sites*	660	660	660	660	660
........Bald Eagle Perching Habitat*	206	206	206	206	206
........Plant Species Habitat*	150	150	150	150	150
RIPARIAN HABITAT EFFECTED (acres)	1038	820	840	399	256

1) Average of subwatersheds significantly impacted by fire
2) Weighted average for all effected subwatersheds
* Key Indicator

Figure II-1 Alternative comparison by issue

ALTERNATIVE COMPARISON BY ISSUE

VISUALS / RECREATION

INDICATOR	B	C	D	F	E
Land Allocation					
—Retention Foreground					
........Forest Plan per decade harvest rate	5	5	5	5	5
........first decade harvest rate (% of area)*	14	10	9	9	0
—Partial Retention Middleground					
........Forest Plan per decade harvest rate	10	10	10	10	10
........first decade harvest rate (% of area)*	35	26	21	19	0
Recovery Rate of Vegetation to meet VQOs* 1) (years)	30	30	30	30	30

1) Visual Quality Objective
* Key Indicator

SOCIAL / ECONOMIC

INDICATOR	B	C	D	F	E
Economic Efficiency					
—net benefits* (mm$) 1989-1990	38.3	33.5	31.5	23.0	-0.7
—present net value* (mm$) 1989-2039	103.8	98.0	98.2	88.6	77.0
Economic & Social Impacts 1989-1990					
—county revenues* (mm$)	10.5	9.4	8.6	6.6	0
—jobs* (number,direct)	903	820	763	560	6
—wage income* (mm$)	18.5	16.8	15.6	11.5	.125

* Key Indicator

Figure II-1 Alternative comparison by issue

SOILS

Any amount of organic material on a site would contribute to soil nutrient status and condition. Information is lacking about the effects of removing soil-organic material on soil productivity. However, we can use estimates of total organic material to infer relative differences between alternatives (Figure II-2). Alternative B would remove the greatest amount of merchantable material and slash and would result in retaining 71 percent (206 tons/acre) of the total organic material (TOM). The difference between this and leaving all of the organic material under Alternative E infers a relative difference in soil-nutrient reserves and does not indicate a significant difference in soil productivity between alternatives.

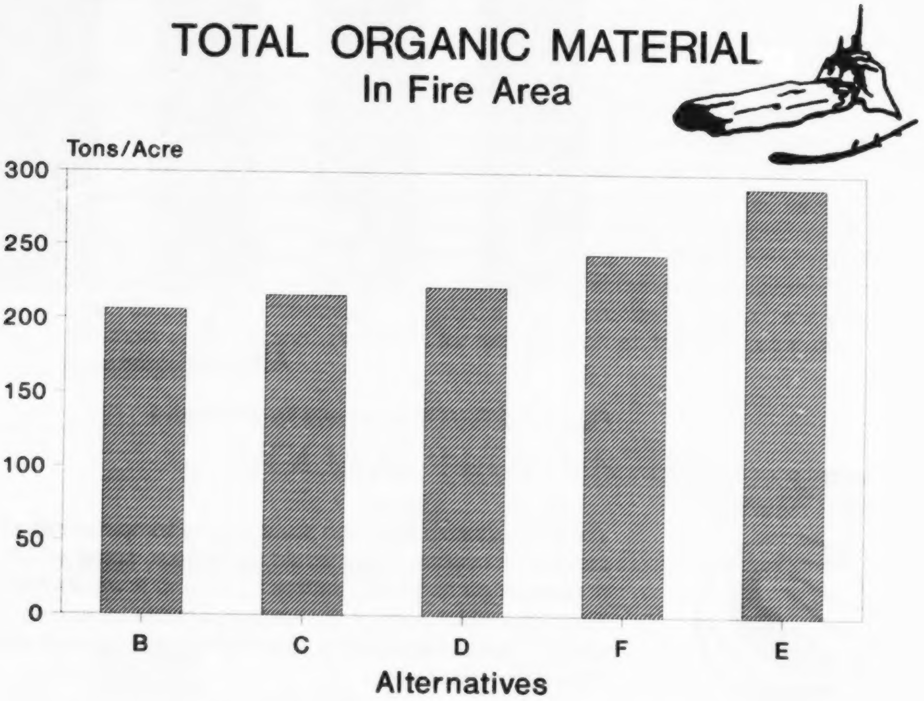


Figure II-2 Total organic material in the fire area by alternative

Varying amounts of road construction and regeneration harvest would contribute to predicted erosion rate differences between alternatives. Alternative B would produce the greatest amount of potential total erosion (1.20 cu.yds./ac./yr.). Alternative E would have an erosion rate of 1.14 cubic yards per acre per year resulting from high-intensity burns on areas with potentially high erosion rates (Figure II-3).

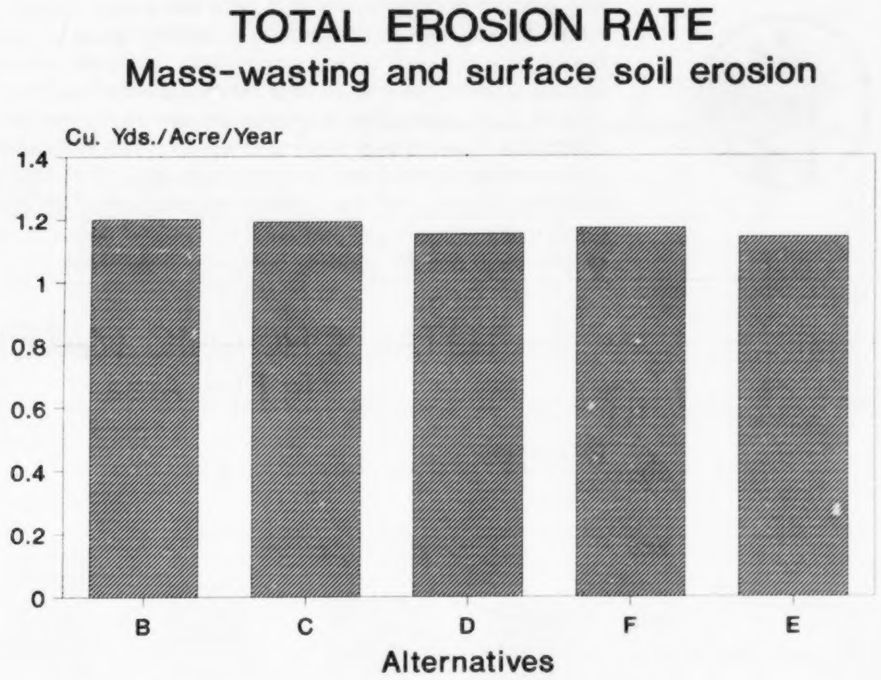


Figure II-3 Total erosion rate by alternative

WATER QUALITY/
FISH HABITAT

The cummulative effect on summertime temperatures of Class II and III streams in harvest areas would increase to some extent. However, harvest in riparian areas in Alternatives C, D, and F would include mitigating measures which restrict stream temperature increases. Alternative B would result in measurable temperature increases in several streams with reduced shading vegetation.

Aggregate recovery percentage (ARP) averages for each alternative are displayed in Figure II-1. There is a 4 percent difference between Alternatives B and E. The ARP reductions from Alternatives E to B correspond to the amount of green timber that would be harvested. A closer look at individual subdrainages shows that ARP would take a sharper reduction in some subdrainages under Alternatives B and C. For instance Modoc Creek would be reduced by up to 8 percent under Alternative C and up to 13 percent under Alternative B. Peak flow increases from rain-on-snow events could be significant in these subdrainages under these alternatives.

Sediment yield and turbidity would increase in all action alternatives due to increased soil erosion rates as a result of timber harvesting and road construction. The Erosion Index (Figure II-1) is a relative indicator of potential sediment delivery with no mitigation above Best Management Practices (BMPs). The Erosion Index is used, along with fire intensity and fisheries, to identify sensitive or high risk subdrainages that will require additional mitigation measures above BMP mitigation. Erosion Index values for Alternative B indicate that implementation of this alternative would have a high potential of generating detectable sediment and turbidity increases in two subdrainages. Index values for implementation of Alternatives C and F would indicate a high potential of generating detectable sediment and turbidity increases in two subdrainages and implementation of Alternative D would indicate a low potential of generating detectable sediment and turbidity. The fisheries and angler beneficial uses would not be measurably affected because turbidity increases occur during high flows of winter and spring. Alternatives B, C, D, and F would not significantly increase water temperature, sediment yield, or turbidity in Hills Creek Reservoir.

TIMBER

Timber harvested within the project area would be included as part of the sale volume normally sold on the Willamette National Forest. Harvest volumes displayed in Figure II-1 are volume estimates that would be removed during 1989 and 1990. Figure II-4 displays the relative timber volume differences between alternatives. Alternative B would harvest the most dead and green volume. The greatest difference between Alternatives C and D would be the amount of green volume removed. Alternative D would have the greatest number of acres partial cut and harvest slightly more dead timber than Alternative C (Figure II-5). Alternative B would harvest the most acres of land unsuitable for reforestation and Alternative F the least (Figure II-6).

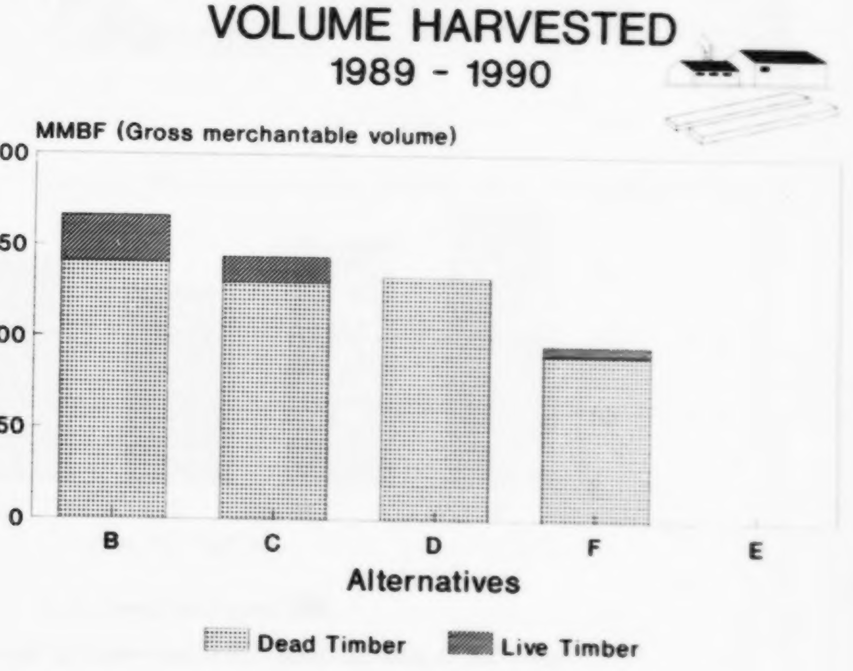


Figure II-4 Volume harvested by alternative

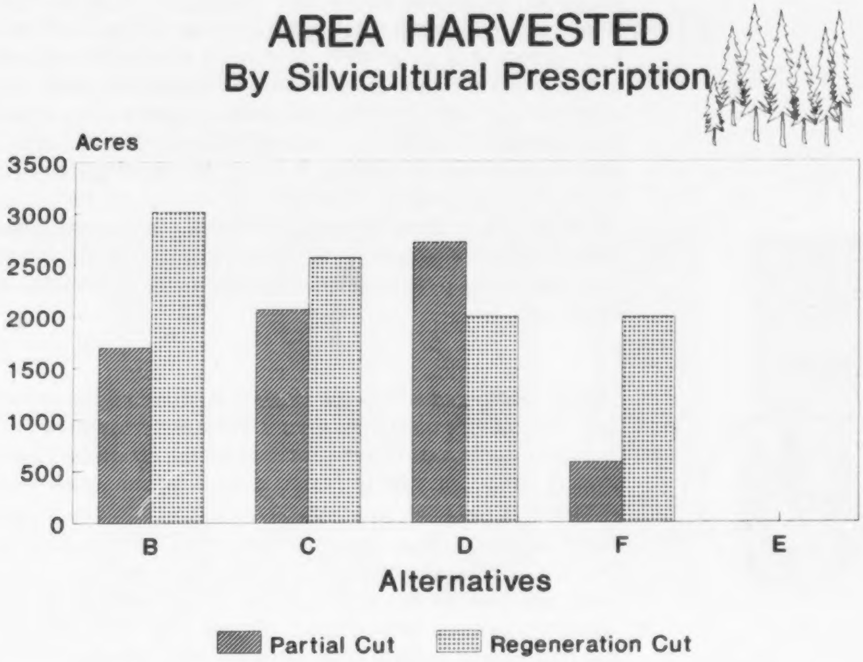


Figure II-5 Area harvested by Silvicultural prescription by alternative

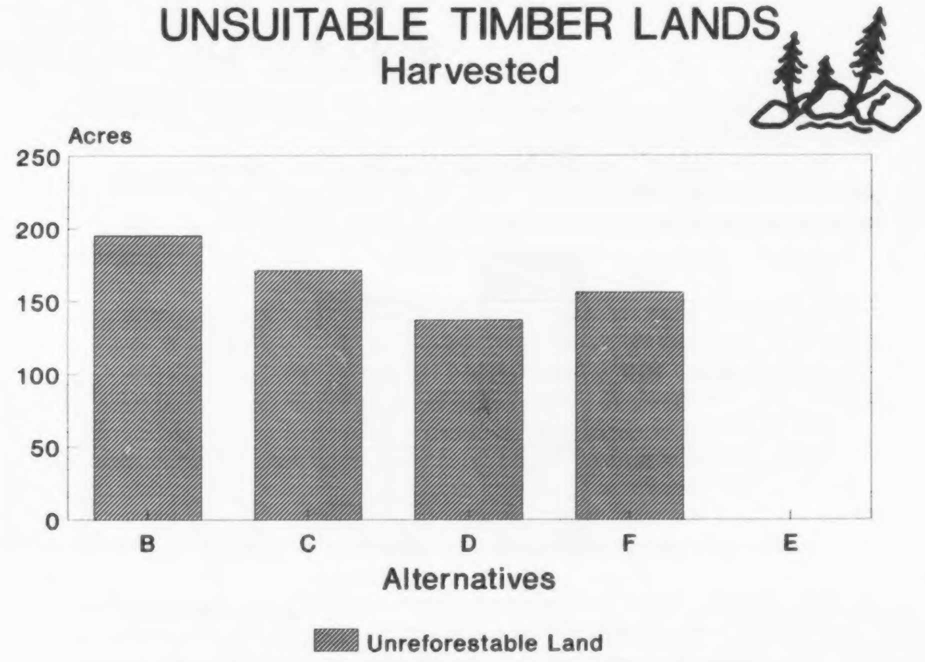


Figure II-6 Unsuitable timber lands harvested by alternative

The volume growth loss displayed in Figure II-1 and Figure II-7 represents the volume foregone when comparing the growth and yield of a theoretical maximum harvesting prescription to each alternative over an 80-year period from 1989 to 2069. Alternative B would have the lowest growth loss and Alternative E the highest. Alternative D would harvest significantly more area by helicopter than the other alternatives (Figure II-8). Alternative B would result in the greatest amount of new road construction (Figure II-9).

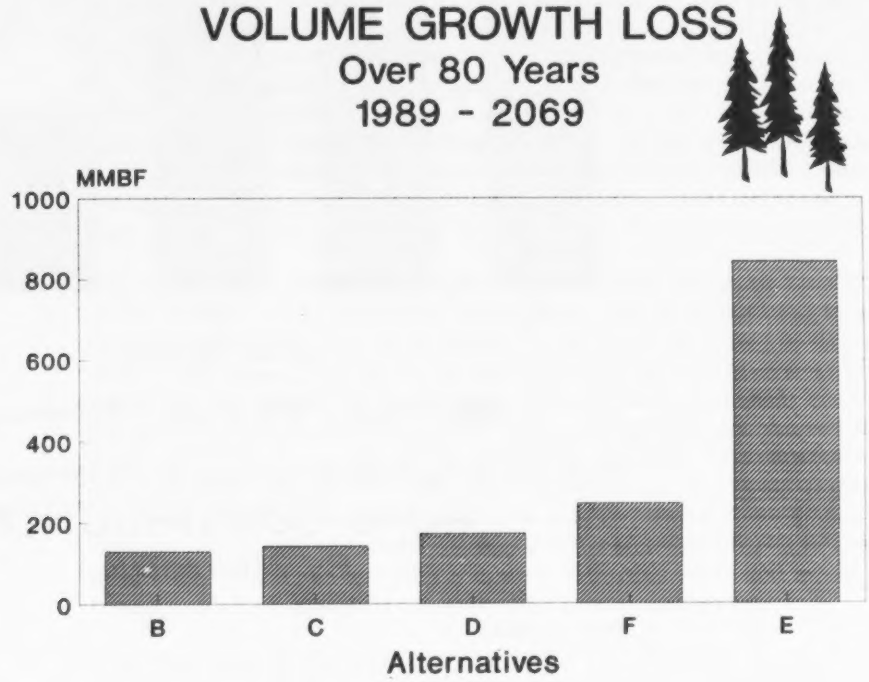


Figure II-7 Volume growth loss over 80 years (1989-2069) by alternative

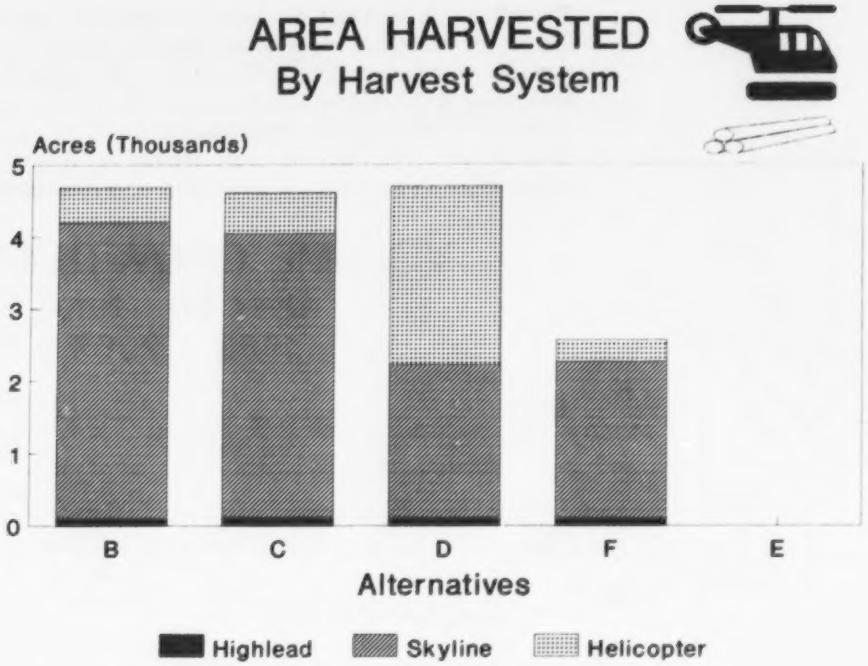


Figure II-8 Area harvested by harvest system by alternative

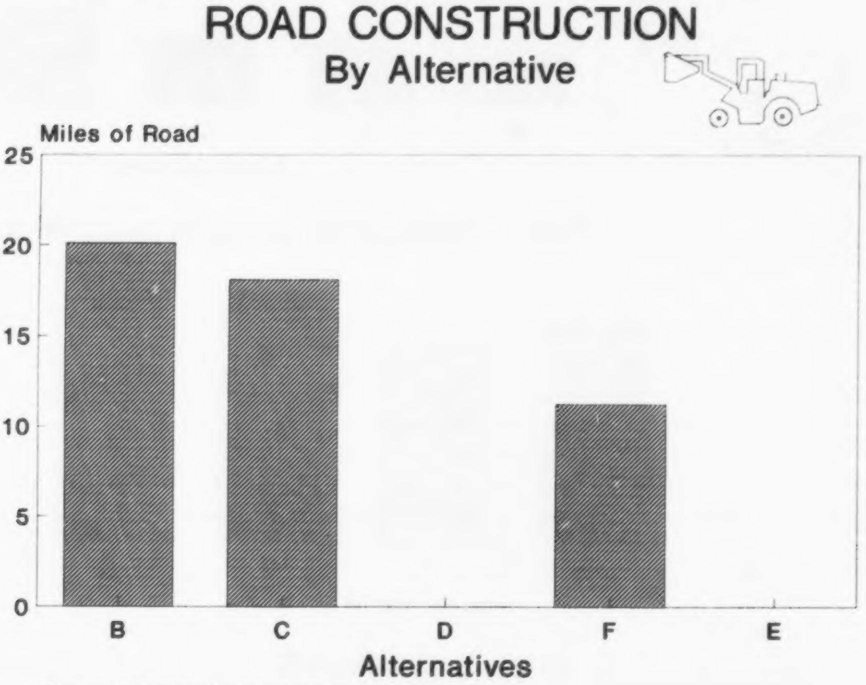


Figure II-9 Road construction by alternative

WILDLIFE HABITAT

Figure II-1 displays overall effects on wildlife habitat for big game, old-growth dependent species, interior forest-dependent species, dead and defective trees, threatened, endangered, and sensitive species, and riparian-dependent species.

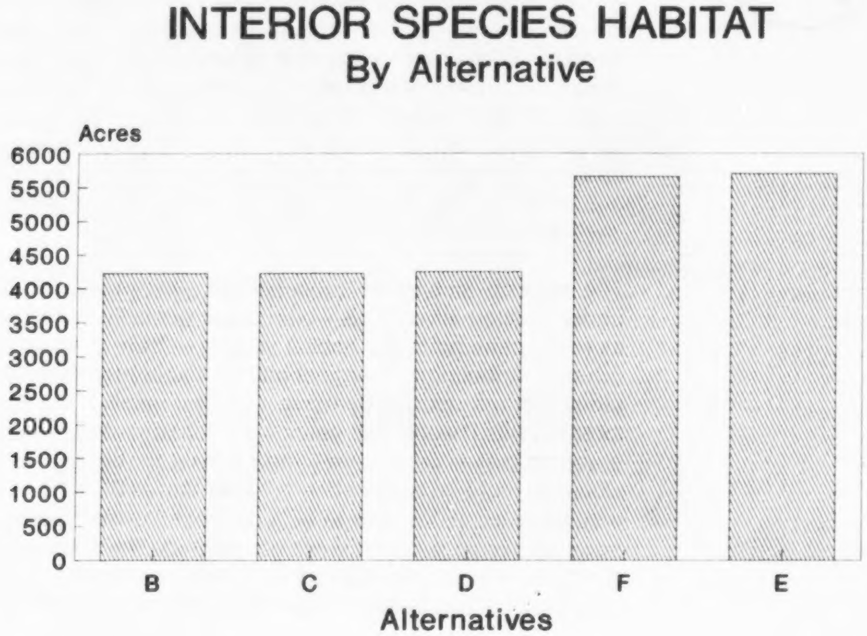
A Habitat Quality Index (HQI) was used to compare impacts to big game for each alternative. This index was calculated using specific habitat attributes such as forage/cover area size, spacing, quality, and road density. Figure II-1 displays weighted HQI averages for all alternatives. Index values indicate habitat conditions between .60 and .99 as highly viable, .40 to .59 as viable, and .20 to .39 as marginal. While it appears that there are subtle differences between alternatives, more specific trend differences are apparent when habitat attributes are examined within each subwatershed affected by the alternatives.

The most obvious trend is that habitat quality would decline by Year 22 under all alternatives. This would occur primarily because the initial forage increase contributing to habitat viability in Year 0 would grow into hiding cover contributing to marginal habitat viability by Year 22. In other words, areas that are opened by harvest or as a result of fire are initially good forage areas. Twenty-two years later, forest re-establishment makes these areas no longer productive forage habitat for big-game. This situation would be more pronounced under Alternatives B and C as they substantially contribute additional forage beyond what the fire created. Alternative D, however, would neither benefit nor degrade the short- or long-term habitat quality as it would not convert any functional thermal cover and would create much less quality forage than other action alternatives.

The other trend is that Alternatives E and F would provide the best opportunity for habitat quality throughout the next 2 decades. This is because these alternatives would leave more green trees, thus maintaining more of the limited low-elevation winter range thermal cover in the short-term to sustain big-game populations through severe winters. Alternatives E and F would also help provide for long-term forage needs because maintaining blocks of green timber now would provide future opportunities to either harvest some timber to create forage, or maintain timber stands for thermal cover. The forage/hiding/ thermal cover display in Figure II-1 indicates this major difference as Alternatives E and F maintain 30 and 27 percent thermal cover. Alternative D would also maintain future options to create forage through scheduled timber harvest.

Big-game thermal cover differs by 13 percent between Alternatives B and E. Partial cut stands presently provide minimum crown closure for thermal cover. It is assumed that harvest activities in partial cut stands would create enough crown damage so that these stands would no longer meet thermal cover requirements. These stands would become hiding cover after harvest.

An index was used to evaluate impacts to interior forest-dependent species such as the northern flying squirrel, red backed vole, and Oregon slender salamander. The overall Interior Habitat Index (IHI) for interior forest-dependent species (Figure II-1) shows very subtle differences between alternatives. More specific trend differences are apparent when looking at the total number of habitat patches and habitat acres that would remain after implementation (Figures II-1 and II-10). Alternatives E and F would provide more habitat patches, substantially more acres, and two important patches in the critical habitat connection corridor along Hills Creek compared with Alternatives B, C, and D.



Acres of suitable habitat
Weighted average IHI for all affected subwatersheds; range 0.40 to 0.41

Figure II-10 Acres suitable interior species habitat by alternative

The potential percent population capacity for primary cavity excavator (woodpecker) habitat was estimated through identifying dead and defective tree habitat. Alternative B would would meet current habitat needs. Alternatives C and D meet both current and future habitat needs. Alternative F is better than both current and future needs, thus supporting the highest population levels. Figure II-11 displays the effects by alternative.

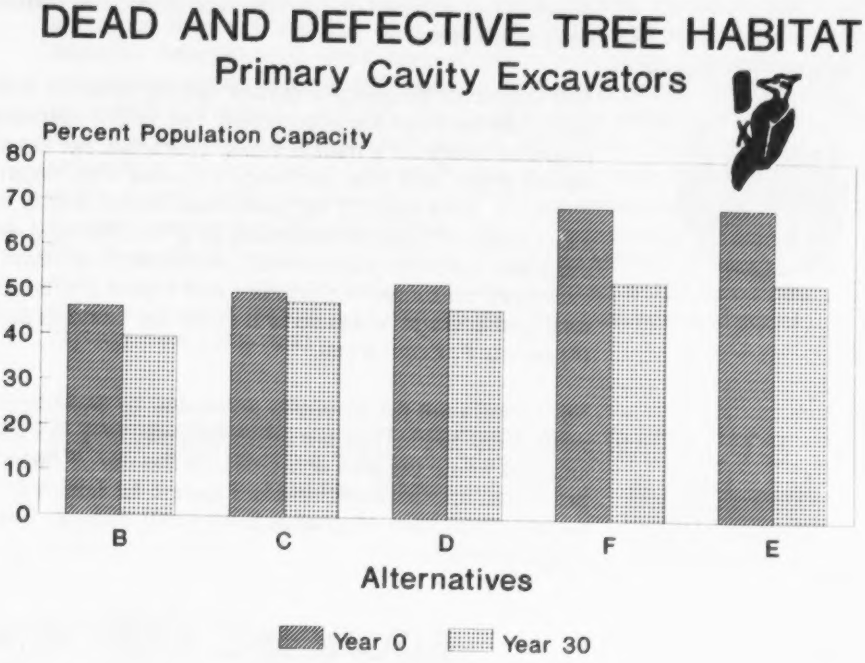


Figure II-11 Dead and defective tree habitat, primary cavity excavators by alternative

Designated suitable habitat acres for old-growth dependent, threatened, endangered, and sensitive species are displayed in Figure II-1. The main difference between alternatives is that Alternative B would not maintain acres for old-growth dependent species habitat, and Alternative F would provide for future northern spotted owl suitable habitat by retaining the 1,500-acre Bull Creek SOHA. Alternatives C and D would designate several smaller blocks of habitat for old-growth dependant species. The SOHA presently has 971 acres of suitable habitat. It also has 529 acres of unsuitable habitat that would take about 80-120 years to become suitable habitat under Alternative F.

Changes to riparian habitat are correlated to the number of acres that would be harvested under each alternative.

VISUALS/RECREATION

None of the alternatives, except the No Action, would meet the visual quality objectives for the first decade harvest rates specified in the Proposed Plan/DEIS standards and guidelines (5 percent for retention and 10 percent for partial retention). Alternatives D and F retain a higher percent of area in a natural condition, or more visually pleasing to the eye than Alternatives B and C.

The fire itself is considered a natural process and has not caused any visually degrading disturbance. The visual quality recovery period for all Alternatives is based on the return of landscape texture, line, form, and color in 30 years.

SOCIAL/ECONOMIC

The economic efficiency analyses display absolute and relative monetary trade-offs between the alternatives. The timber resource was the only resource assigned a market value. Therefore, net benefits, present net values (PNV), and jobs and wage incomes were determined by 1) the timber volumes sold, 2) log production costs, and 3) the mitigation costs associated with volume reductions (e.g. wildlife trees) required to implement the timber sales program for each alternative. In addition to the key economic indicators presented in Chapter I and Figure II-1, detailed comparisons of total and average revenues and costs are found in tables F1, F2, and F3 (Appendix F, Economics).

Net benefits are net revenues generated by alternative for the project years 1989-1990. They are presented with PNV in Figure II-1. The PNV includes future benefits and costs for the next 5 decades, including those generated for the project years. Figure II-12 illustrates the PNV and net benefit range from Alternative B (highest) through Alternatives C, D, F, and E (lowest).

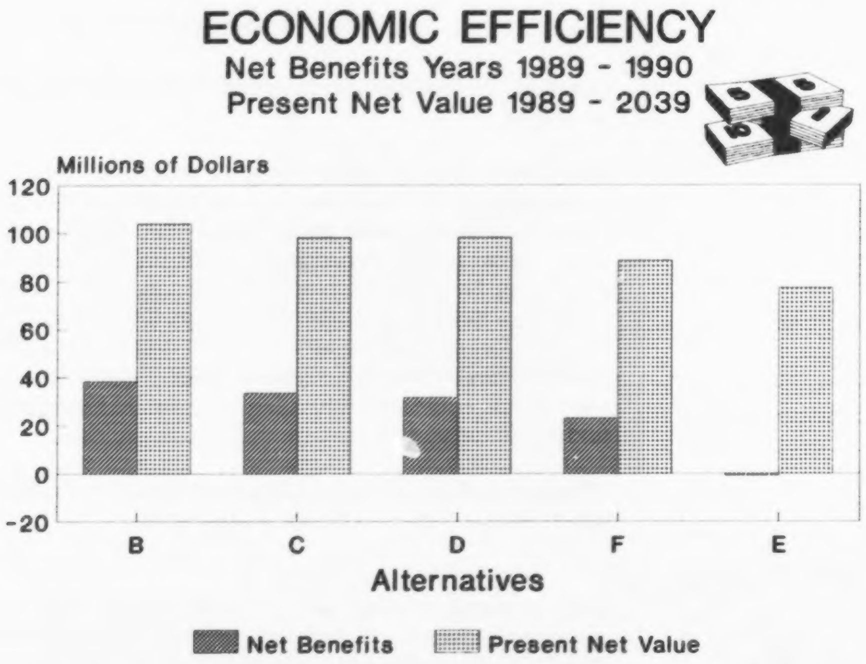


Figure II-12 Economic efficiency, net benefits years 1989-1990 and present net value 1989-2039 by alternative

Payments to county and Federal treasuries were estimated for 1989 and 1990 (Figure II-13). Generally, alternatives that harvest more timber relative to others also provide more revenue to the treasuries. However, this difference does not hold true on a per MBF basis for all alternatives. For example, Alternatives C and D harvest similar volumes but Alternative D returns less dollars on a per MBF basis to the Federal and county treasuries (Appendix F, Tables F1 and F2). The logging costs would be $14/MBF higher in Alternative D ($116/MBF) than in Alternative C ($102/MBF) due primarily to the increase in helicopter units in Alternative D. The increase in the logging costs between alternatives would reduce receipts to the Federal treasury and revenue sharing payments to county governments. The trade-off for the decreased dollar returns per MBF in Alternative D is that no green volume would be harvested and there would be no new road construction. Figure II-13 also displays the economic and social impacts from 1989-1990.

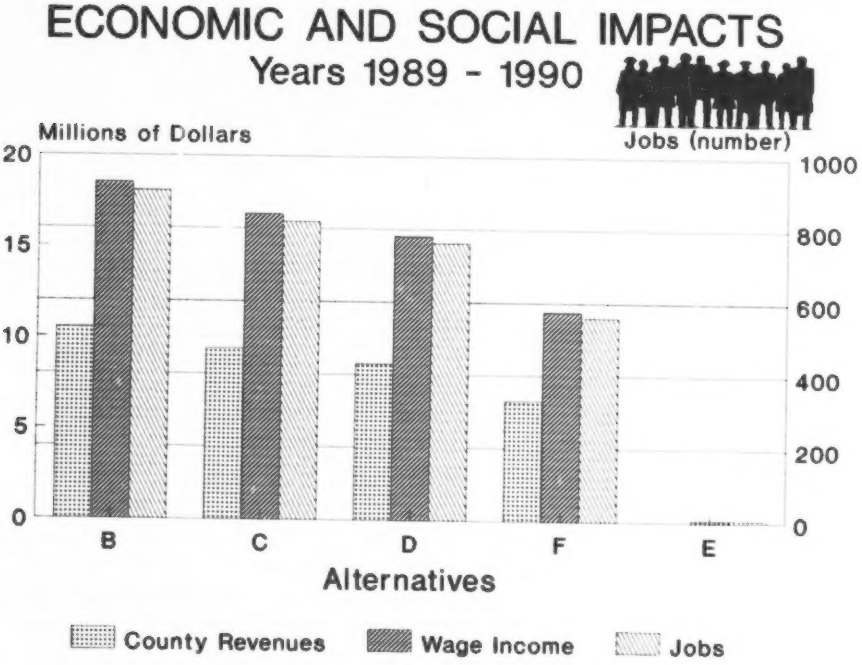


Figure II-13 Economic and social impacts years 1989-1990 by alternative

Jobs and income dollars generated from timber salvage sales were estimated for the 2-year salvage operation and for green sales in the next 5 decades. These include logging, mill, tree planting, road construction and maintenance, and Forest Service jobs.

THE AFFECTED ENVIRONMENT

INTRODUCTION

This chapter describes those portions of the physical, biological, and social and economic environment that may be affected by management activities proposed during the analysis of the Shady Beach Fire Recovery Project. This is a post-fire description and will provide the basis for assessing the environmental effects of alternative actions described in Chapter IV, (Environmental Consequences).

The analysis area covers 22,456 acres immediately to the east of the Hills Creek Reservoir where 9,163 acres burned during the Shady Beach forest fire of September, 1988. Elevations range from about 1,500 feet above sea level at the surface of the reservoir to nearly 6,500 feet at the top of Wolf Mountain which is at the eastern end of the analysis area. Topography is quite variable. The western half in the vicinity of Tufti Mountain is steep and sharply dissected, and the eastern portion between Cougar Mountain and Beach Mountain is fairly gentle and rolling.

This area generally contains productive sites for timber growth due to the deep, fine-textured soils. The climate is typical of the maritime-influenced climate of the Cascade range, although it is somewhat hotter and drier than areas of similar elevation to the north. Most of the area receives 50 inches or less of precipitation per year, most of which falls during the winter and spring months (Legard and Meyer, 1971).

LAND OWNERSHIP AND CONDITION

Of the 22,456 acres of the analysis area, about 880 are privately owned by Pope & Talbot, Inc., the owner of the sawmill in Oakridge. Most of this area was in young conifer plantations prior to the fire and all the acres were severely burned during the Shady Beach fire. Another 160 acres are owned by the Boy Scouts of America and is used as a summer camp. This land was partially harvested 40 to 50 years ago and is currently covered with a young, closed-canopy stand of trees with occasional, older trees scattered throughout. The rest of the analysis area is public land administered by the United States Department of Agriculture (USDA) Forest Service, Willamette National Forest. The condition of this land is completely described in the preceding sections of this Chapter.

PAST MANAGEMENT

Approximately 129 miles of road has been constructed in the analysis area prior to the fire. During the past 30 years, about 7,900 acres (35%) of the analysis area has been harvested. This includes most of the 1,040 acres of privately owned land that is within the analysis area. Within the fire area 2,675 acres (29%) had been previously harvested, 1,795 on national forest and 880 on private.

GEOLOGY AND SOILS

GEOLOGY

Bedrock in the analysis area consists of a variety of volcanic rocks including lava flows, tuffs, breccias, and mud flows. The lavas are andesites, basalts, and dacites. When unweathered, these rocks are dark gray to black and generally hard and durable. About 30 percent of the area is underlain by these types of rocks. Soils developed from lavas tend to be shallow and rocky on the ridges and steep slopes which are underlain by flow rocks. Terrain developed on these rocks tends to be stable except for shallow debris slides in steep drainages and isolated slumps of deep pockets of soil.

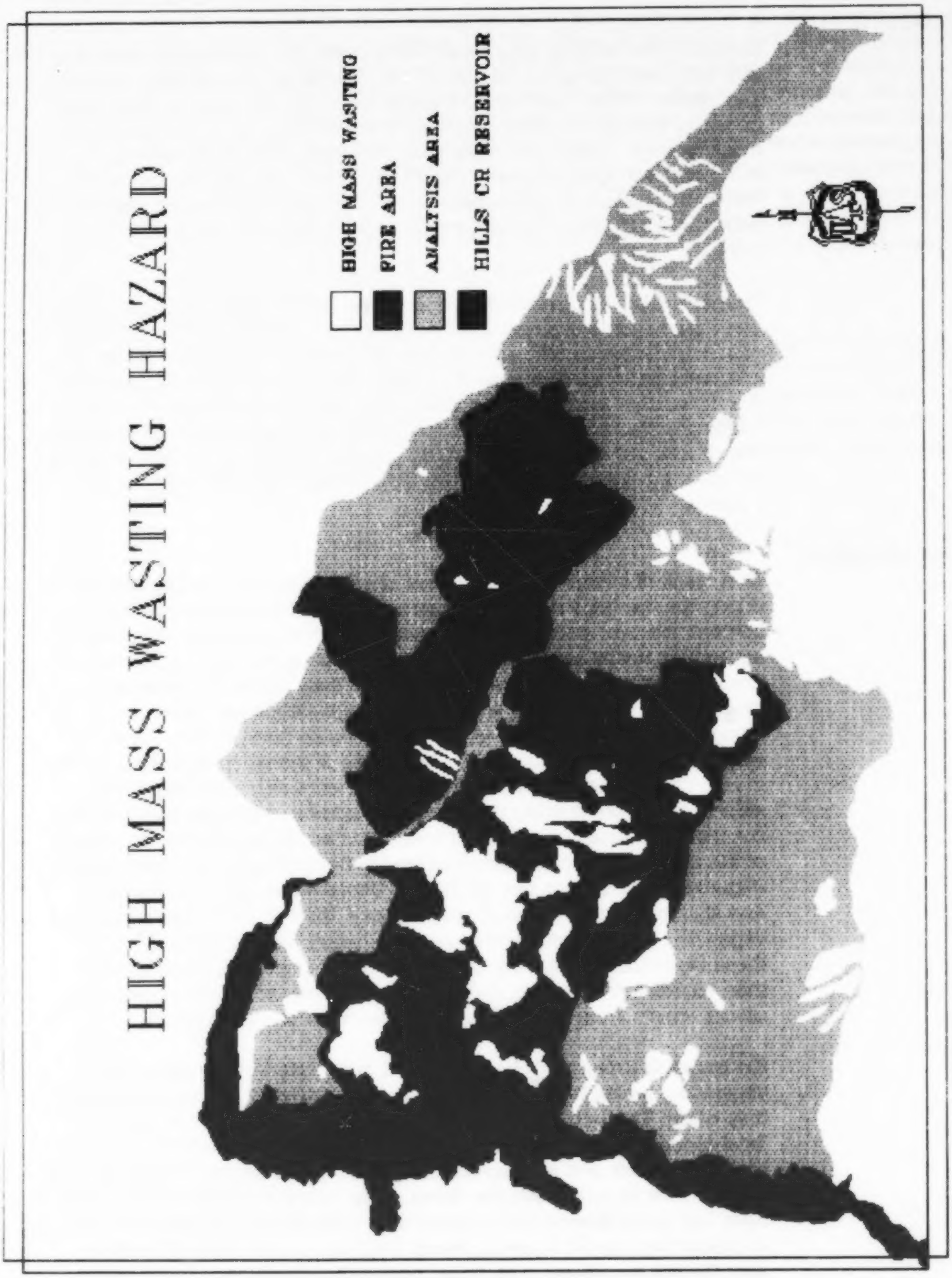
Tuffs are deposits of volcanic ash. Breccias are deposits of volcanic rocks that include numerous rock fragments. About 70 percent of the planning area is underlain by tuffs and breccias. In general, these rocks are much less resistant to weathering and erosion than the lava deposits, and they readily weather to deep, fine-grained soils. Terrain underlain by tuffs is marginally stable, at best, and some varieties are very unstable (Burroughs and others, 1976). Landslide-earthflow deposits cover about 25 percent of the area, mostly consisting of deep soils derived from tuff and breccia bedrock.

Recent Landslides

As a result of intermittently high rates of surface erosion and landsliding during the last few million years, many slopes, particularly those over 75 percent, are over-steepened. This means that the inclination of the slopes exceeds or nearly exceeds the angle of repose of the soils on the slopes. These over-steepened slopes are the most likely places for mass soil movement to occur. In the analysis area, over-steepened slopes occur along many stream banks, even in the flat areas north of Hills Creek, as well as in the upper sections and headwalls of the steep drainages south of Hills Creek. Some road cut slopes make artificially over-steepened slopes. These areas make up small, isolated portions of the analysis area but most landslides occur in this type of terrain. Approximately 11 percent of the analysis area is classified as having high potential for mass wasting (Figure III-1) which includes landslides, debris flows, debris avalanches, and slumps. In many areas of steep slopes and thin soils, root strength of vegetation is an important force helping to keep soils in place. Most of these landslides directly affect less than a few acres of ground or less than 10,000 cubic yards of soil and rock, but they can have significant off-site effects if the material that slides enters a stream channel.

On landslide-prone slopes where forest fires have killed most of the vegetation, pre-existing landslides may be reactivated and new landslides may occur. This occurs because loss of transpiring vegetation leads to local concentrations of ground water. This extra ground water drains towards stream channels and may surface as fire-enhanced seeps or small failures of stream banks and headwalls. Small, steep draws, even those that usually have little or no flowing water, have more water flowing in them and will undercut their banks in some places. Deposits of soil, built up in draws over the years between high flows, have been observed to move down-

Figure III-1 High mass wasting hazard



stream. A gradual decline in the root strength of fire-killed stands of trees also contributes to increased landslide activity, especially in shallow-soiled areas. Some headwalls of steep, narrow drainages will become eroded to bedrock or have new debris slides. Such events have been occurring within the fire area such as in the lower end of Tufti Creek during the rains of November, 1988.

SOILS

The geologic history of this area has had a great influence on the development of soil characteristics. A variety of soils occur in the analysis area as described in the Soil Resource Inventory (SRI) for the Willamette National Forest (Legard and Meyer, 1971). These soils as a group can be typified as being deep, fine-textured, relatively fertile, and moderately unstable and erosive.

The primary soils in the fire boundary and the analysis area were developed from the highly weathered tuff and breccia bed rocks. These soils vary in depth from 0 to greater than 10 feet, with shallower soils occurring in steeper topography. The topography varies in slope from less than 20 percent to greater than 90 percent. The weathering of the tuff and breccia rock generally results in a fine-textured soil ranging from silt loam to clay. Approximately 79 percent of the analysis area contains soils with these characteristics.

Minor soils of the project area are those forming from the andesites and basalts and the deep, (greater than 10 feet) valley bottom soils formed from deposits of fairly recent alluvium and colluvium. Approximately 20 percent of the analysis area contains soils with these characteristics.

SOIL PRODUCTIVITY

The deep, fine-textured soils that predominate in the analysis area provide some of the best tree-growing sites on the Willamette National Forest. Only about 6 percent of the project area is considered unsuited for timber management as per current legislation and policies requiring capability to regenerate a site within 5 years following timber harvest. The area unsuited for timber harvest includes forested rock outcrops, soils of greater than 70 percent rock content on dry south exposures, and minor areas on other than south exposures that are not plantable due to rockiness.

Soil productivity is dependent on the continued addition of organic materials to the nutrient cycling processes. Nitrogen, the most limiting nutrient in the forest soils of the Pacific Northwest, is mineralized or made available by the biological decomposition of organic materials such as woody debris, needles, twigs, leaves, and other dead plant materials. Organic material and resulting humus also aids in moisture retention, soil-aggregate stability, and surface soil protection from erosion or rainfall impact.

The amount of total organic material (TOM) present gives an indication of the relative productivity of a given soil or site. TOM is a measure of above-ground, ground level, and below-ground organic material and its decomposition product, organic matter, or humus. Components include down and standing organic material such as vegetation or large and small woody debris, forest floor litter and duff (partially decomposed organic material), and surface and subsurface soil organic matter and roots.

The pre-fire distribution of the above-ground (tree and shrub) component of TOM varies widely from clearcut, slash-treated lands to fully stocked mature stands of timber. Pre-fire weights (in managed and unmanaged stands) of above-ground organic material ranges from 4 tons/acre to 250 tons/acre. The ground component of TOM, composed of forest floor litter and humus, ranges from 19 to 99 tons/acre. About 87 to 136 tons/acre is organic matter for the below-ground component. Post-fire weights of above-ground organic material ranges from 2 tons/acre to 250 tons/acre. The post-fire ground component ranges from 3 tons/acre to 99 tons/acre. Below-ground post-fire soil organic matter ranges from 85 tons/acre to 136 tons/acre. Figure III-2 displays the distribution of total organic material both pre- and post-fire. Pre-fire estimates of TOM in the fire area averaged 341 tons/acre as compared to the post-fire average of 291 tons/acre, resulting in a 15 percent reduction in TOM due to the fire.

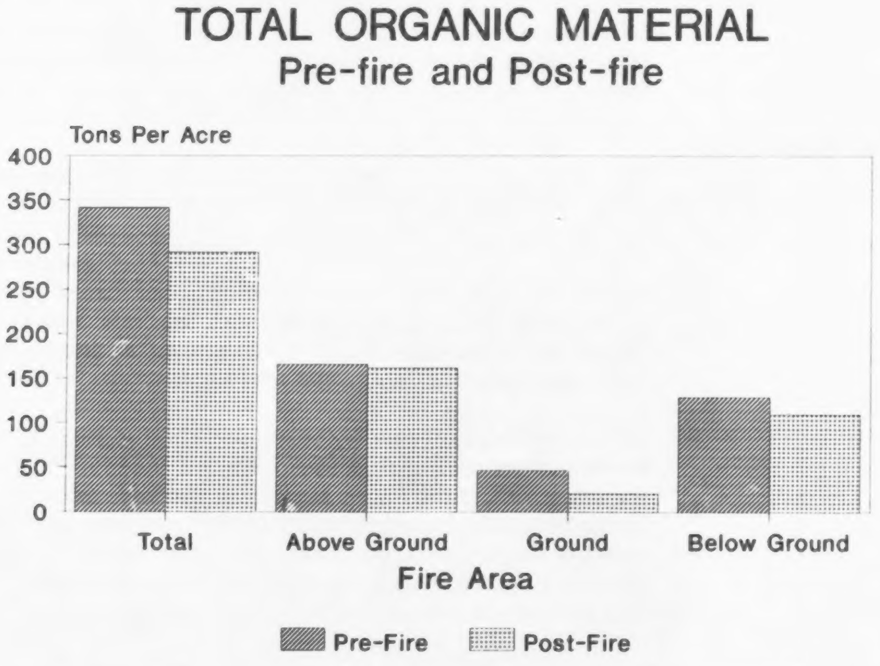


Figure III-2 Pre- and Post-Fire Distribution of total organic material (TOM)

Fire Effects on Soil Productivity

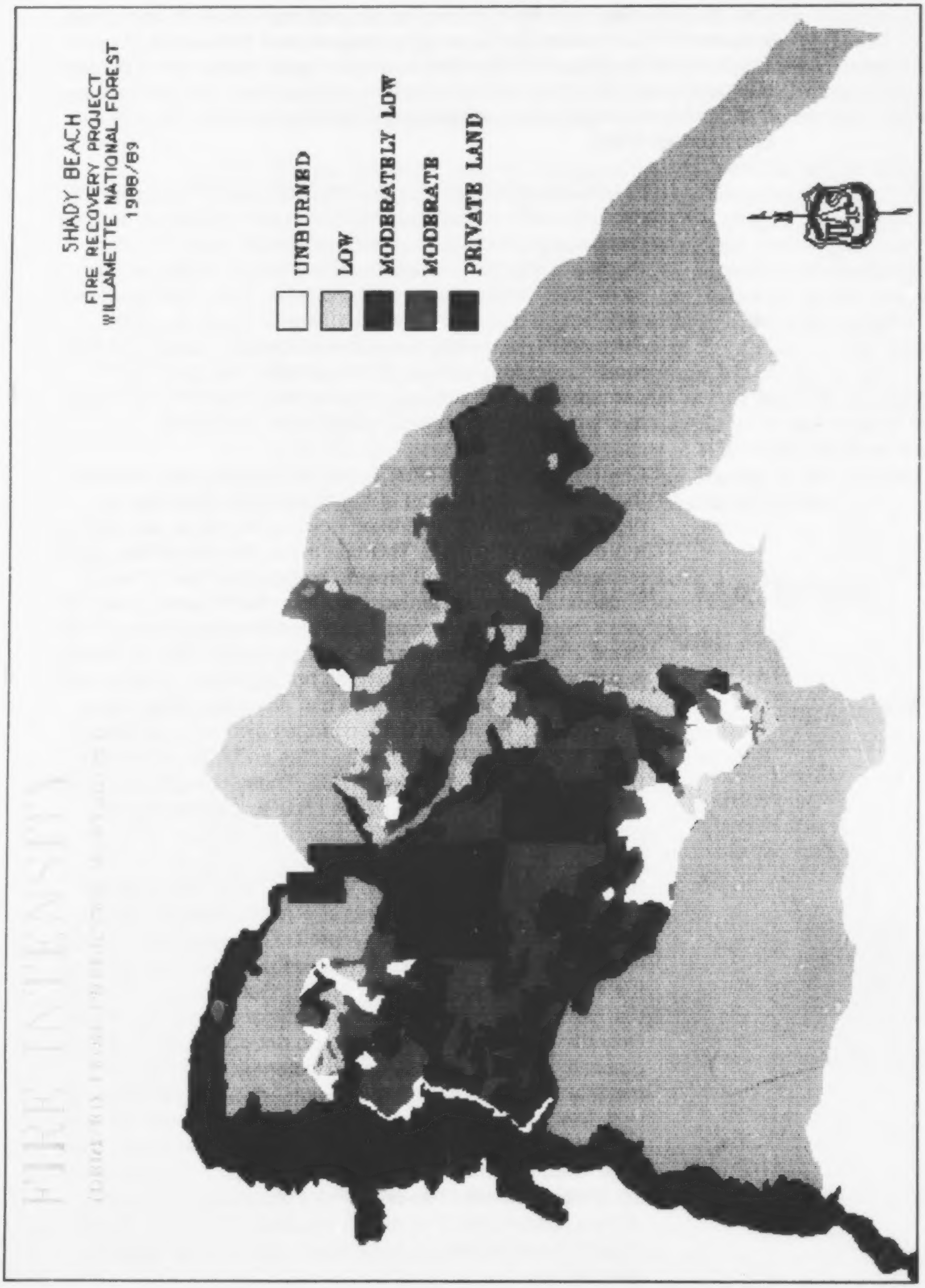
The greatest effect that fire can have on the soil resource is to accelerate erosion of the soil material that has accumulated over thousands of years. This includes the loss of surface litter and soil organic matter which contain a large percentage of the soil's available nutrients. There are several ways that fire has accelerated soil erosion within the fire boundary (Figure III-3, Fire Intensity Map):

1. CHANGES IN WATER REPELLENCY: Depending on the fire intensity, soil particles can be coated with volatilized organic compounds that make the soil temporarily water repellant (hydrophobic). This causes overland flow of water and an increase in surface-soil erosion potential. This water repellency may last up to 5 years in Cascade soils (Dyrness 1976). Such changes usually occur in areas which experience the most severe fire intensity. It is estimated that less than 5 percent of the fire area experienced fire intensities sufficient to create some amount of hydrophobic conditions.

2. CHANGES IN SOIL STRUCTURE: Soil aggregates, particles formed from aggregation of the fine mineral particles by organic matter, can be broken down if the soil is exposed to a great amount of heat. This can make the soil surface more susceptible to ravel and erosion by overland flow of water. These changes may also be temporary, but in some instances, years may be required to re-establish soil-aggregate structure. Since a fine textured soil is poorly aerated and water availability is decreased due to fine particles holding tightly to absorbed water, changes in soil structure can adversely affect future plant growth. Such structural changes also result in lower water infiltration and percolation rates and may make soils prone to puddling and compaction. These changes occurred in areas that experienced intense fire, approximately 20 percent of the fire area.

3. REMOVAL OF VEGETATION, DUFF, LITTER, AND LARGE WOODY MATERIAL: This layer of organic material, which normally covers the forest floor, protects the soil from raindrop impact, (the beginning of the erosion process) and stabilizes the slope, to some extent, by limiting the amount of material that can be transferred by overland flow of water or by raveling. Only the lowest of fire intensities do not contribute to this potential increase in soil-erosion potential. This organic material also plays a large role in nutrient cycling and storage. Duff, litter, and most larger woody debris was removed over about 20 percent of the fire area. In those areas where trees were killed and the crowns were not completely burned, the fall of dead needles has provided a significant replacement of the organic layer. For more complete information on soil organic material refer to Appendix A, Soils: Total Organic Material.

Figure III-3 Fire Intensity, derived from predicted mortality



4. REDUCTION OF ROOT STRENGTH: Roots provide a great deal of strength to the soil, especially on the steep, thinly soiled slopes. When conifer vegetation is killed by fire, the roots remain but they soon start to deteriorate. Roots of large conifers provide the most soil strength and will last for years after a tree's death but with a diminishing effect from year to year. Roots of brush species and other perennial plants provide some soil strength but they are small and deteriorate rapidly. Generally, minimum soil strength values due to tree root decay occur from 3 to 10 years after clearcut harvest. This is also the period of maximum mass-wasting erosion following wildfires (McHugh 1986). Even low-intensity fires can kill most of the above-ground portions of vegetation. In areas dominated by conifers trees that do not have the capability to resprout, a low-intensity underburn can cause a dramatic loss in rooting strength. In areas with a significant amount of hardwood brush, tree species, or other perennial plants that can resprout from the root crown, rooting strength may be reduced for a short time but will recover within several years. About 52 percent of the fire area was burned severely enough to kill the dominant vegetation contributing to root strength.

In addition to erosional losses, site productivity can be affected through the loss of nutrients volatilized during the fire. This happens mostly to various nitrogen compounds. Nitrogen is one of the most limiting nutrients in western cascade, Douglas-fir, forest ecosystems (Miller and others, 1976). Nitrogen compounds in forms usable by plants are found in the upper-most, organic matter rich soil layers. Most of the nitrogen is chemically bonded to the soil particles and becomes available to plants only over time. Therefore, the loss of the organic layers could have an affect on short-term site productivity. All of the burned area suffered loss of nitrogen. Other, non-volatilizable, nutrients such as phosphorus or potassium, can also be lost as residual ash is removed by overland water flow.

Soil-Erosion Potential

The fine-textured soils mentioned previously have the potential to be relatively erodible and unstable, especially when disturbed by such activities as road building, equipment movement or naturally occurring landslides. The most significant process for downslope movement of soil in this area is mass wasting which includes debris avalanches, debris torrents, slumps or earthflows, and landslides. The relatively steep, shallow, noncohesive soils over bedrock tend to experience debris avalanches and debris torrents. The deeper, plastic, clay soils are more subject to slump-earthflows.

Surface-soil erosion is a process highly dependent on slope, soil texture, protective ground-cover (duff and forest floor litter), vegetation, and the influence of water. Both roots and above-ground plants and woody material on the forest floor are important in stabilizing slopes. The fine root mass of plants plays an important role in binding the surface soils. All soils not protected by ground cover or vegetation will be subject to some level of surface-soil erosion. In the analysis area, surface-soil erosion generally occurs in minor amounts due to the existence of stable soil aggregates held together by clay soil particles and incorporated organic matter. More erosional energy is required to move these stable aggregates as compared to noncohesive granitic or sandy soils. Surface erosion occurs on noncohesive soils when the surface organic layer is removed and raindrop impact detaches the weakly aggregated soil particles, seals the surface of the soil, and/or reduces infiltration. In the fire area where surface organic material has been consumed, a high-intensity, long-duration storm event may produce enough energy to transport surface soil material. In this analysis area, most soil erosion occurs on steep slopes adjacent to stream channels or headwalls, or as the result of stream-channel erosion due to increased water flow.

Soil-erosion potential is aggravated by the rerouting of water associated with road drainage. Roads may intercept ground and surface water, concentrate it, and route it into land areas that may not be able to absorb additional water input without some slope failure. The result is soil erosion which may include one or more of these types of erosion: 1) surface-soil erosion (generally forming rills or gullies), and 2) mass wasting. The erosional processes may involve detachment of the soil by concentrated water or by water filling the void spaces between the soil particles. When deep, fine-textured soils become saturated, the lubrication and weight provided by the water tends to make the soil mass unstable. Road placement and construction practices are the most important factors in minimizing the increase in erosion as a result of management activities in the analysis area.

Rehabilitation Accomplished

While fire suppression activities attempted to limit the spread of fire, an emergency fire rehabilitation project was underway. As of the end of October, approximately 700 acres of land with severe erosion potential, primarily drainage headwalls, and 92 acres of riparian areas were seeded to grass to minimize soil erosion that inevitably comes with the onset of fall rains. In addition, 28 miles of fire line were water-barred, and 25 of those miles were seeded with grass during the fire mop-up efforts to minimize erosion.

WATER AND FISH

WATER

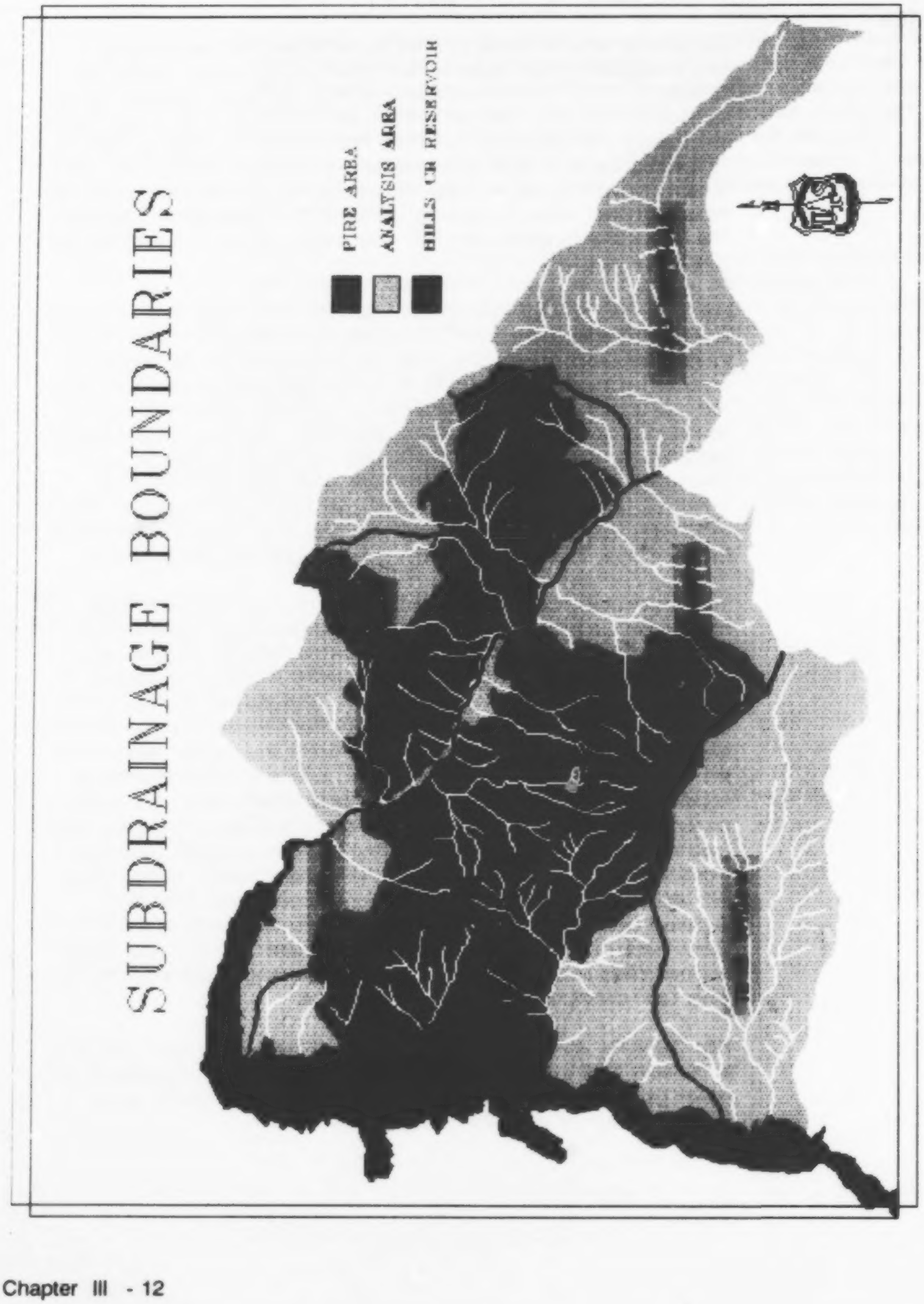
The analysis area is entirely tributary to the Willamette River which, in turn, is tributary to the Columbia River. It includes portions of two of the 19 watersheds that have been delineated on the Willamette National Forest: the Middle Fork of the Willamette River, and Hills Creek. Both watersheds flow through the Hills Creek Reservoir. The analysis area was established by the boundaries of eight subwatersheds in which the Shady Beach fire occurred. Two of these are within the watershed of the Middle Fork of the Willamette River, while the other six are within the watershed of Hills Creek. The eight subwatersheds, with their boundaries, names, and numbers are shown in Figure III-4.

Hills Creek is the only Class I stream (see Glossary for definition of stream class) in the area and it provides important spawning and rearing habitat for fish. Two trout species are present in the streams and the reservoir contains trout, crappie, and bass. Class II streams also provide important fish habitat and influence the water quality of Class I streams. Class III streams are perennial with little or no fish habitat; Class IV streams flow intermittently. Both Class III and IV streams are major contributors to downstream conditions. The Clean Water Amendments of 1972 (U.S. Congress 1972) specify that all Federal agencies must comply with state requirements for abatement of water pollution. The Oregon Department of Environmental Quality (ODEQ 1988) provides those specific guidelines.

The quality of the water flowing through and coming from the analysis area and in the Hills Creek Reservoir is considered to be good except during high winter flows when turbidity may be high, or during summer low-flow periods when segments of some streams exceed 58 degrees F. Turbidity in the reservoir is influenced by water conditions in Hills Creek and the Middle Fork of the Willamette River. The turbidity of these streams and their tributaries occurs in pulses. These streams rapidly recover from these turbidity increases, which are due to local and temporal unstable conditions within the watersheds. Concerns for water quality have centered on turbidity (fine sediment that is suspended in the water), sediment loads (coarser sediments that are moved along a stream channel), peak flow increases, and water temperature. All these characteristics directly affect fish habitat and indirectly affect recreational experiences. In addition, sediment loads can affect downstream improvements such as the Hills Creek Reservoir which will eventually be filled with these fine and coarse bedload sediments. Other pollutants, such as sewage, hydrocarbons, or other toxic chemicals do not occur in this area.

Hills Creek Reservoir, on the western edge of the analysis area, was built in the early 1960's as a flood control structure, and it also provides some power generation and recreational opportunities. The reservoir has a useable storage of about 234,300 acre feet of water.

Figure III-4 Subwatershed Boundaries



Precipitation

Precipitation measurements at the Rigdon Ranger District, the closest weather station (about 5 miles away) to the analysis area, show an average of 47 inches per year over the last 10 years. The range of precipitation over this period has been from 31 to 59 inches per year. Precipitation increases somewhat with elevation, therefore precipitation on the analysis area is likely to be a bit more than these measurements show. Fifty-six percent of the annual precipitation occurs during the period from November through February. Some of this precipitation falls as snow which accumulates and quickly melts as described in the following section on peak flows and the transitional snow zone.

Channel Morphology

Nearly all the streams in the analysis area have incised channels as a result of the erodible nature of the soils and parent material. Portions of these channels are bedrock, but most of the streams are in alluvial or colluvial material including silts, sands, cobbles, and very large boulders. Pieces of large woody debris play an important role in stabilizing alluvial channels. Most stream reaches have a relatively large amount of large woody debris except where this debris was removed during timber harvest or by the Shady Beach fire. Woody debris in western Cascade streams may hold as much bedload as 10 to 20 times the annual amount of sediment movement (Swanson and Lienkaemper, 1978; Swanson and Fredricksen, 1982) and this is typical of all streams in the analysis area. Streams within the fire area where this debris was partially or wholly consumed will produce high amounts of sediment during winter peak flows until the stored sediment moves out of the system or until stabilizing debris is replaced. Approximately 16 percent of the stream length within the analysis area was burned intensely enough to remove or partially remove the stabilizing woody debris.

In areas where trees in riparian areas have been killed, the amount of large woody debris available for addition to the stream system, both long- and short-term, has changed. Green trees are a source for this addition on a long-term basis. Trees that were killed will be available for input in a shorter length of time. As a result of the fire, the availability of short-term woody debris was increased, in that there is more standing dead (burned) trees in riparian areas. Conversely, there is a reduction of green trees, thus the long-term availability for recruitment of woody debris into the stream has been reduced.

Water Quality

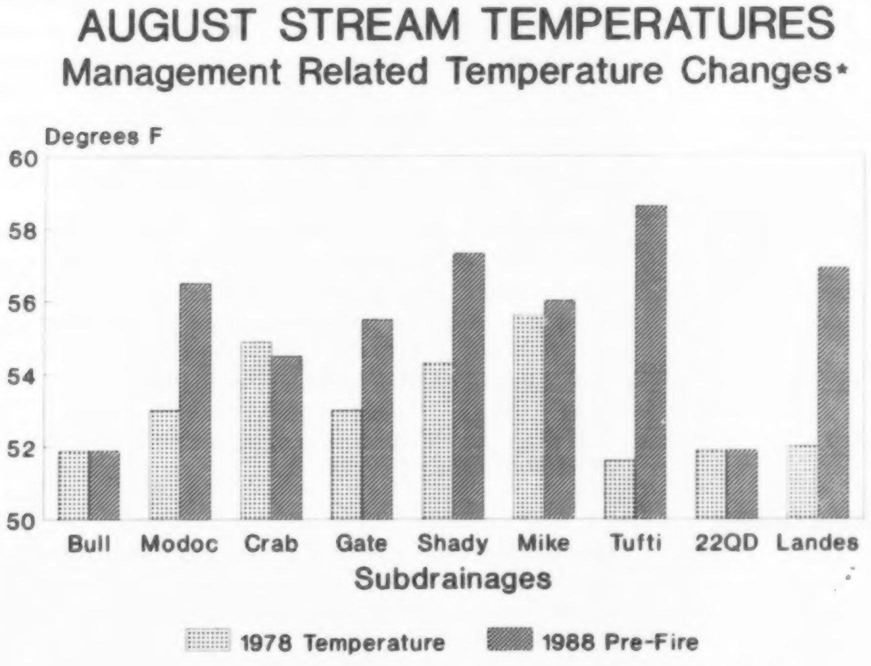
Streams and other water resources within the analysis area are classified according to their beneficial uses. The primary beneficial uses for the Middle Fork of the Willamette River and Hills Creek Reservoir is fish habitat and the flood control and power generating functions of Hills Creek Reservoir. Another infrequent beneficial use is an emergency source of domestic water. The City of Lowell, some 25 miles downstream from the analysis areas, maintains an emergency water system that would draw water from Dexter Lake, another reservoir on the Middle Fork of the Willamette River, if the City's wells cannot supply its needs. The quality of this water affects these beneficial uses.

Water temperature, turbidity, and sediment transport are affected by a number of stream-channel characteristics, including amount and type of riparian vegetation, large woody debris incorporated into the stream channel, soil type and parent material through which the stream flows, and channel morphology. Water quality is also affected by management activities occurring in the watershed, natural catastrophes such as wildfire, precipitation amounts and patterns, and erosion from upslope areas entering the stream system.

There are about 55 miles of perennial streams within the analysis area, of which 15 miles occur within the fire perimeter. Most of these are tributaries of Hills Creek, the only Class I stream in the area. Several streams flow directly into Hills Creek Reservoir. Most streams in the area are typical of Cascade Mountain channels; they tend to have a large amount of adjacent vegetation providing channel shading and woody debris input.

Temperature

Stream temperatures have increased over natural levels as a result of management activities such as road construction and timber harvest. The summertime maximum temperature of a number of Class II and Class III streams were estimated to have had pre-fire temperatures above 58 degrees F (see Figure III-5).



*Based on Data from Landes Ck

Figure III-5 Temperature increases related to pre-fire management activities

With the exception of those stream reaches which have been burned, the streams in the analysis area tend to have a well-developed, multi-leveled layer of shading vegetation. The loss of riparian vegetation from the fire and the corresponding reduction in stream shade will most likely cause an increase in water temperature that will last until shading vegetation is re-established. However, because the burn area makes up only 15 percent of the drainage area for Hills Creek, the temperature increase of Hills Creek is estimated to be less than 1 degree F. See Figure III-6 for estimates of post-fire stream temperatures. Stream temperature is directly proportional to exposure of the stream surface to sunlight and inversely proportional to stream flow.

ESTIMATED STREAM TEMPERATURES
(August Mean Temperatures degrees F)

Stream Name	Pre-Fire	Post-Fire
Gate Creek	55.5	57.2
Mike Creek	56.0	62.0
Modoc Creek	51.9	52.3
Bull Creek	53.0	54.5
Kitson Creek	51.9	51.9
Tufti Creek	58.6	62.0
Unnamed stream tributary to Hills Creek 122 PC	52.6	54.6
Skipper Creek	52.8	52.9
Crabapple Creek	54.5	57.8
Landes Creek	56.9	57.9
Shady Creek	57.3	60.4

Figure III-6 Estimated stream temperatures

The United States Geological Survey (USGS 1988) has monitored water temperatures at a stream gauge on Hills Creek from 1958 to 1984. These data show that the temperature of Hills Creek exceeds 58 degrees F for 91 percent of the days recorded in August for the period of record. Temperatures as high as 70 degrees F have been recorded.

The average maximum daily temperatures for each day in August multiplied by the average flow and the weight of 1 cubic foot of water is a measure of the heat flow (British Thermal Units (BTUs)/second) carried by Hills Creek. Flow multiplied by temperature above 58 degrees F plotted, over time, is presented in Figure III-7 which shows a definite increase in heat flow over the period of record. For a similar period, Beschta and Taylor (1988) reports a decrease in the average air temperature which indicates the increase in stream temperature is not related to climatic change.

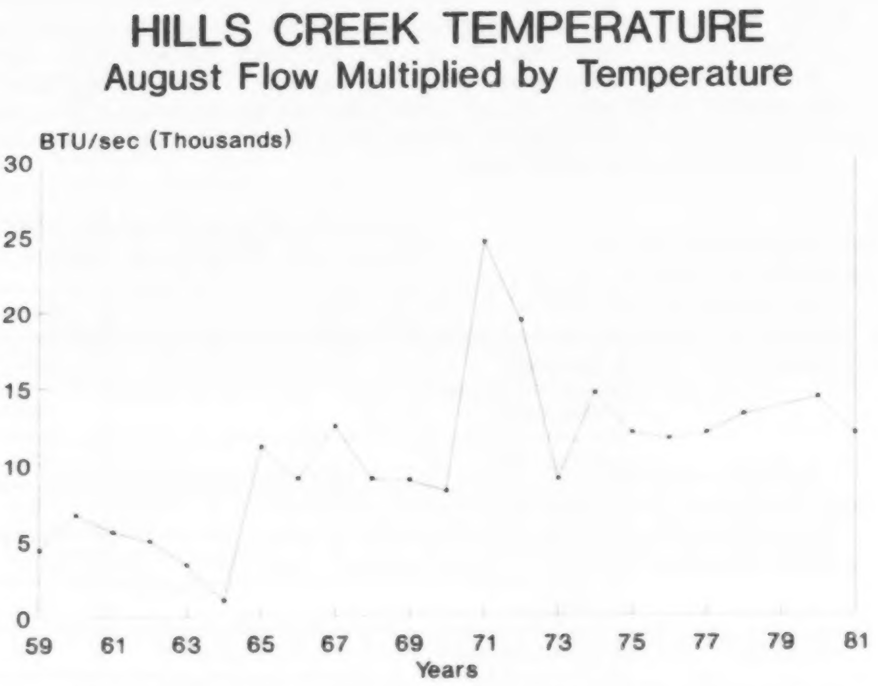
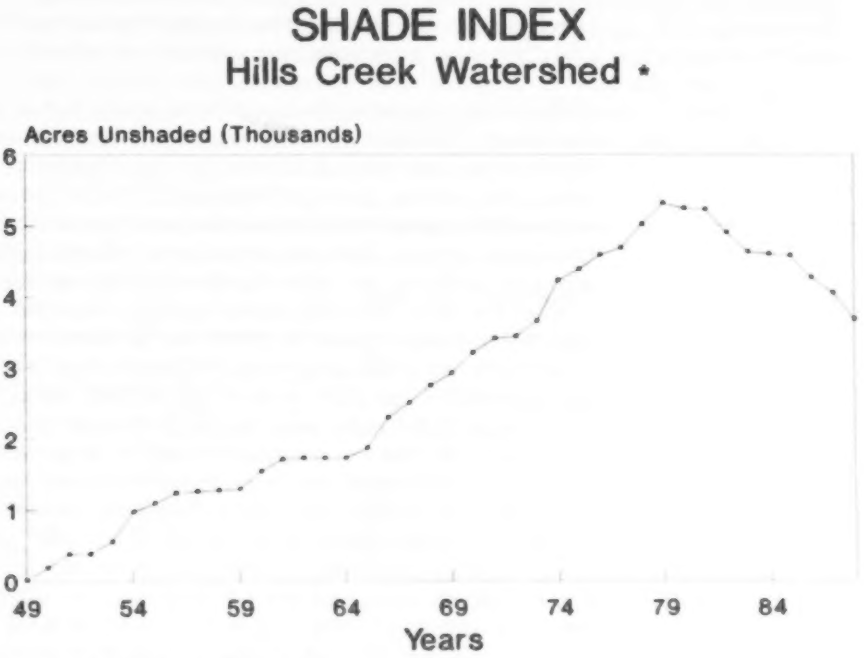


Figure III-7 Hills Creek temperature (August flow multiplied by temperature)

An index of the cumulative effects of forest management as presented by Beschta and Taylor (1988) was calculated for Hills Creek. This index is based upon the shade recovery rate and the amount of harvest in a watershed. This index plotted, over time (Figure III-8), shows a steady increase of management effects through 1979 and a decline in those effects from 1979 through 1987. The protection of riparian buffer strips for stream shade retention was increased around 1979. However, a second study of Beschta and Taylor's (1988) index and flow data indicates that increases in temperature may be the result of destruction of riparian vegetation and corresponding loss of shade after severe flood events (Froelich 1988).

The Rigdon Ranger District has monitored streamflow and temperature at three stations on Landes Creek and one on Mike Creek during 1977. The data from Landes Creek establish a baseline temperature of 58 degrees F for the month of August. Temperature data for Mike Creek shows temperatures as high as 78 degrees F following logging operations. Past management activities have contributed to an estimated 3 degree F increase in summer water temperatures throughout the analysis area (see Appendix B, Hydrology).



- Assumes All Harvest is Clear Cut
- Does Not Include Private Lands

Figure III-8 Shade Index, Hills Creek watershed

Stream Flows and the Transitional Snow Zone

Stream gauge readings from the last 20 years on Hills Creek show an average annual flow of 150 cubic feet per second (CFS). The mean monthly flow for August, September, and October is 32, 31, and 44 CFS respectively. The lowest flow rate recorded has been 14 CFS while the 10-year flood level flow is 3,800 CFS (Friday and Miller, 1984).

Studies show that the removal of forest cover increases streamflow and flood frequency. The effect is believed to be caused by a reduction in melting and evaporation losses and increased snow accumulations in cutover areas (Harr 1987). Reduced transpiration losses also contribute to this phenomenon.

The winter peak flows can be described as having a frequency of occurrence based upon their magnitude. A flood of a given size can be expected on the average every so many years; and, the larger the peak flow, the more infrequent its return rate. As the size of peak flows increase, so does the amount of channel erosion and amount of bedload sediment movement. Larger peak flows in the western Cascades generally occur during or immediately preceding a wind and rain on snow event where a warm rain falls on a snow pack, causing it to melt rapidly. The deeper the snow pack and the greater the amount of rain, the larger the resultant flow. Cascade snow packs are very dense and contain large amounts of water per volume of snow. They are relatively warm, being at or near freezing throughout their existence (Christner and Harr, 1982). This causes the snow pack to melt quickly when exposed to warm rain or air flow; and, when the snow pack melts, large amounts of water are produced.

Another characteristic of the Cascade snowpack is that, in middle elevations from about 1,500 feet to 4,000 feet, the snowpack is transitional. Due to the relatively warm temperatures in this elevation band, the snow accumulates during storms and melts between storms. A dense forest cover can modify the accumulation of this snow pack by catching a portion of the snow in the canopy. This intercepted snow will melt faster due to its greater exposure to the air and solar radiation and the resultant water is then free to enter the soil or stream system, resulting in a more or less constant input to the stream system as this snow falls and melts. In areas lacking forest cover, snow will accumulate to greater depths because it will not melt as readily when there is much less surface area presented to the air than it would if the snow were caught by the tree crowns. This increased snow pack then has the potential to produce large amounts of runoff during periods of warm rain or wind that can cause rapid melting of the snow. The lack of vegetation also exposes the snowpack to winds that contribute to quick melting when the winds are warm. A warm rainstorm of a given magnitude will produce more runoff over a shorter period of time if it falls on an accumulated snow pack in an opening than would have been produced if the area was forested. As a result, floods become more frequent and channel erosion is more likely to occur.

AGGREGATE RECOVERY PERCENTAGE

The Willamette National Forest uses an index to predict the likelihood of peak-flow increases that reflects the relative ability of the vegetation in a watershed or subwatershed to modify the accumulation of snow in the transitional snow zone. This index is called the aggregate recovery percentage (ARP). This index assumes that once a specific area of forest is cleared of trees, it contributes to an increase in peak flow until it recovers hydrologically, which can take up to 30 years. Recovery is assumed to be complete when the trees in a stand have grown to an average diameter of 9 inches, assuming the canopy is at least 70 percent closed. This recovery occurs incrementally, and a young plantation is considered partially recovered based upon its size and stocking. Stands killed by fire, or with at least 30 percent of the stand killed, are not considered to be fully recovered since bare standing trees have little ability to catch snow or transpire soil moisture.

Recovery percentages are calculated and averaged for all stands in a subwatershed. The 1,041 acres of privately owned lands that occur in Modoc, Kitson and Tufti subwatersheds are included in this analysis. About 85 percent of the privately owned land was covered with young plantations having low-recovery values before they were burned in the fire. This yields an average value for the amount of area covered by vegetation capable of modifying the transitional snow pack. The ARP equation used by the Willamette National Forest predicts that after 28 years, planted conifer trees will have full crown closure, thus producing 100 percent aggregate recovery percentage. The cumulative effects of past management has reduced the ARP value in the analysis area to 60 percent. The ARP value was further reduced from 60 percent to 48 percent as a result of the fire. Pre- and post-fire ARP values have been determined for the eight subwatersheds of the project area and are displayed in Figure III-9. As this index decreases, channel erosion is more likely to occur during storms that would normally not produce the same amount of sediment movement if the vegetation in an area was in an undisturbed condition.

ARP VALUES BY SUBWATERSHED

Subwatershed Number	Subwatershed Name	Acres	ARP Pre-fire	ARP Post-fire
121A	Modoc	3883	80	60
121B	Willow	3758	57	57
122B	Shady Gate	2974	56	41
122C	Mike	2391	54	37
122D	Warfield	3342	54	54
122P	Tufti	1940	51	25
122Q	Kitson	1388	48	43
122R	Landes	2685	61	54

Figure III-9 ARP values by subwatershed

The ARP index integrates all of the factors associated with timber harvest including: 1) increased water yield due to reduced transpiration, 2) snow redistribution, 3) snow melt, and 4) the conversion from vegetated to non-vegetated conditions due to the construction of roads and landings. In the Proposed Forest Plan/DEIS, the ARP values are used to estimate changes in streamflow, sediment yield, and turbidity.

Sediment Movement

The movement of sediment through the stream system of the analysis area affects the quality and amount of fish habitat and the function of the Hills Creek Reservoir for flood water storage. The flood control ability of the reservoir could be diminished as sediment coarse enough to settle out of the water builds up above the powerhouse intake. An increase in the rate of sedimentation could decrease the length of time that this structure would serve that flood control function. There is no information on the amount of sediment that has entered this reservoir since its construction.

Prior to the Shady Beach fire, The Willamette National Forest estimated 1986 erosion in the Hills Creek watershed to be about 305 cubic yards of material per square mile of watershed. The natural rate of erosion was estimated to be 163 cubic yards of eroded material per square mile, which means that about 47 percent of the current erosion

best copy available

rate has been generated by past and present management activities. The Upper Middle Fork of the Willamette River watershed was estimated to have a current erosion rate of 201 cubic yards with a natural rate of 128 cubic yards while the Middle Fork of the Willamette River watershed has 295 and 149 cubic yards of material respectively (Proposed Forest Plan/DEIS, 1987, page III-31). As a result of the fire, the erosion rate is estimated to increase by 30 cubic yards of material per square mile of watershed for the Middle Fork of the Willamette and 463 cubic yards of material per square mile for Hills Creek.

Turbidity

High flows from post-fire storms in the fall of 1988 have resulted in some channel erosion. The turbidity levels of the streams appears to have risen. Stream samples are being collected by the Rigdon Ranger District but as of this date have not been analysed.

Turbidity in the reservoir has been recognized for years (Youngberg and others, 1971). The watershed of the Middle Fork of the Willamette River, like the analysis area, contains a high proportion of soils with a high clay content. This soil erodes during winter flows as a result of natural and human-caused disturbances. This turbidity would normally be flushed out of the system during winter floods and ultimately be deposited in the ocean but the reservoir retains this flow until late summer when it is slowly drained in preparation for the next winter's high flows. The suspended clay particles will not settle out of the water in a single summer. During summer months, the reservoir turbidity is low to a depth of about 90 feet. Below this depth, there is a strong turbidity gradient which extends to the reservoir floor. The powerhouse intakes are in this zone of turbid water, hence the Middle Fork of the Willamette River below the reservoir is somewhat turbid all year long (Youngberg and others, 1971).

Shoreline turbidity caused by summer wind-wave activity produces locally turbid water that extends as much as 200 feet from the shore at exposed headlands. The sediments causing this turbidity settle out of the water fairly quickly and do not contribute to downstream turbidity.

FISH

The primary fisheries resources within the analysis area are provided by Hills Creek and Hills Creek Reservoir. The area also contains 11 Class II drainages with fish-bearing potential, four of which have confirmed occupancy by fish. Two streams currently classified as Class III have been found to contain fish.

The species of fish known to occur in the stream systems of the analysis area are rainbow trout, both native and stocked, native cutthroat trout, and fresh water sculpin.

The species of fish known to occur in the reservoir are rainbow trout, both native and stocked, native cutthroat trout, white crappie, large-mouth bass, brown bullhead catfish, and a variety of non-game species (suckers, sculpin, and shiners). Dolly Varden trout are suspected to occur in the reservoir, but their occurrence has not been confirmed (Wade 1988).

Fish in both the stream systems and the reservoir are affected by changes in water quality. Stream temperature affects the amount of dissolved oxygen that water can absorb. Dissolved oxygen levels affect survival and are critical for reproductive success. Sedimentation affects the structure of spawning beds which is critical for reproductive success. Sedimentation can also affect reproduction by suffocating juvenile fish or by trapping them in the spawning gravel. Large woody debris in the stream system affect nutrient inputs into the aquatic system as well as structural features of fish habitat, sediment delivery, aeration and stream velocity.

Water quality conditions are addressed in the Water Quality section of this Chapter.

Some of the fish in Hills Creek Reservoir have been stocked; the rainbow trout by the Oregon Department of Fish and Wildlife (ODFW 1977), and the bass and crappie by independent fishermen. The crappie fishing is considered good, but the bass fishing is marginal. This marginal bass fishery is partially due to the cold-water temperature and the fact that the bass have not been in the reservoir long enough to attain maximum population growth. The flood control function of this reservoir also results in less than optimum bass habitat.

The reservoir has low-quality fish habitat due to the large amount of deep, open water, the low amount of structural habitat, and the limited area of shallow waters along the steep shorelines. The main structures within the reservoir are the remnant tree stumps, which offer limited habitat concealment and protection for juvenile fish. The two dominant game fishes, rainbow trout and crappie, rely heavily on plankton feeding which is largely controlled by water nutrients and temperatures. Cascade Mountain streams are typically low in nutrients although the nutrient amounts in the reservoir are higher due to the retained sediments discussed in the water section of this chapter. Nutrients released from the burned area should add peak increases with rain runoff to the reservoir.

Hills Creek contains native cutthroat and rainbow trout, and is stocked with rainbow trout by the ODFW. The water quality in this stream is good but the habitat is not at optimal level due to the effects of the flood in 1964. This flood caused widespread channel changes and loss of riparian vegetation. The subsequent salvage of trees that washed into the stream channel has resulted in a lack of structural habitat that persists to some extent to this day. There is also fish habitat in the tributaries of Hills Creek and in those streams that flow directly into the reservoir. While the habitat in these smaller tributaries is limited due to low summer flows and steep channel gradients, it is a higher quality habitat since it was not affected by the 1964 flood.

Some further degradation of the fish habitat in Hills Creek can be expected as sediment loads from the tributaries increase as a result of the fire. Information is lacking on how much of this sediment will reside in the channel after peak flows. Although the Hills Creek riparian vegetation has not been affected much by the fire, stream temperature will increase during the summer due to the loss of shading vegetation on tributary streams. The predicted change in stream temperature is less than 0.5 degrees F.

This temperature increase is not considered to be significant to aquatic life in Hills Creek. Within these affected tributaries, aquatic dependent species, such as some salamanders and frogs, rely on good water quality and temperature moderation for reproduction and juvenile development in late spring and summer. Trout spawning should not be affected by water temperature since spawning occurs early in the year before water warms; however, sediment additions will definitely affect the amount of spawning area in this stream in the future.

AIR

Air quality is tied very closely to forest residue management, visual quality, and management concerns about using fire to protect and enhance forest resources. Air quality is of particular concern in metropolitan areas of western and eastern central Oregon.

Air pollution from forest fires has been a natural output of Pacific Northwest ecosystems for thousands of years, cycling carbon, and other materials into the atmosphere (Komarek 1970). Forest fires, along with natural hydrocarbon emissions from plants and various kinds of emissions from volcanic eruptions, are major sources of natural air pollution (Pecora 1970; Went 1960). Approximately 13 percent of the total United States particulates emissions originate from forest fires, while prescribed burning contributes another 0.5 percent to the national total (Sandberg 1985).

Of the current management practices on the Willamette National Forest, prescribed burning has the greatest impact on local air quality. This impact is temporary in nature and, unlike emitting facilities such as factories or power generation plants, it is difficult to quantify on a site-specific basis.

Air quality within the analysis area is excellent except for brief periods during the burning of logging-created slash and periods of ongoing wildfires. The Oregon State Department of Forestry regulates the burning of logging slash in accordance with the Oregon Smoke Management Plan (SMP). Burning guidelines specify how many tons of fuel may be burned by elevation, timing, and spacing in the western Cascades as directed by the State Forester's Office. The purpose of these guidelines is to minimize visual and health effects in areas designated by the SMP as smoke sensitive areas. These regulations were developed in compliance with the Clean Air Act (U.S. Congress 1977).

The Clean Air Act specifically protects wilderness areas and National Parks from degradations in air quality. Visibility is the main criteria for determining the quality of the air. The Oregon amendment designates other areas around various municipalities such as the Eugene/Springfield Metropolitan area and the Bend/Redmond area as air-quality designated areas.

Most of the smoke produced by slash burning on the Rigdon Ranger District travels towards the east, generally passing between the Bend/Redmond area and Crater Lake National Park. It is difficult to quantify air quality during periods of slash burning. Computer models are available that can estimate particulate generation depending on fuel loading and fuel moisture. However, this is a very subjective measure of effects as ambient particulate concentrations vary depending upon how far from the source one may wish to analyze.

The biggest effect on the quality of the air in Oakridge is the use of wood for home heating. During the winter, the air in Oakridge often is in excess of State and Federal standards (LRAPA 1988b). Although the City is not designated by the State as an air-quality area, it is thought that it soon will be, due to the fact that these standards are often exceeded. Occasionally, slash burning does affect the quality of the air in Oakridge during the slash burning season. This occurs occasionally when down-canyon winds bring residual smoke into the city from slash burning on the Oakridge and Rigdon Ranger Districts and more often when the Lowell Ranger District of the Willamette National Forest burns slash during west wind conditions. More commonly, the thin haze that is often a dominant feature of the air quality of the area during the summer comes from agricultural burning in the Willamette Valley.

Although the Shady Beach fire had some serious short-term effects on the air quality in Oakridge, the fire was burning under extremely dry conditions with wind directions that do not normally occur during slash burning. Slash disposal generally occurs here only when the prevailing wind is from the west to avoid affecting designated air-quality areas.

VEGETATION

Prior to the Shady Beach fire, the analysis area was covered with mixed species forest stands of various ages ranging in age from several years to over 400 years. Despite the relatively dense forest cover, this area has had an active fire history that has profoundly affected the structure and composition of these forest ecosystems. Many different plant associations, as described by Hemstrom and others (1987), occur in the analysis area ranging from dry, rocky meadows to bogs, and from relatively open forests on dry, south-facing slopes to moist, bottom-land forests. Approximately 87 percent of the area is covered by forest vegetation of various ages.

Approximately half of this area occupies south-facing slopes that present a fairly harsh environment to plants. The south-facing slopes in this area tend to contain plant associations (Hemstrom and others, 1987) that have Douglas-fir or grand fir as the climax species. These slopes may be very dry during the summer because the shallow soil cannot store much moisture or because the deeper soil with a high clay content which hold water so well that it cannot be absorbed easily by plants. Wild fires that periodically burned these drier south-facing slopes and create small openings in the tree canopy where Douglas-fir or grand fir could regenerate. Douglas-fir has dominated these sites due to this periodic fire history, as grand fir is not as capable of surviving underburning. Several other fire-resistant tree species occur in these open stands with Douglas-fir. The most common are incense cedar, ponderosa pine, and sugar pine. Incense cedar will also regenerate under the shade of such stands. Broadleafed trees such as big-leaf maple, Pacific madrone, Oregon white oak, and golden chinquapin also occur occasionally in these stands. The open nature of these stands also provides for a diverse set of understory plants which makes areas like these quite attractive to wildlife.

The other half of the area is on generally northerly slopes and is typically occupied by plant associations with western hemlock as the climax species. Douglas-fir establishes a forest cover on these north-facing slopes first. It often dominates the canopy, due to its ability to live for long periods of time. These north-facing slopes are not exposed to as much solar radiation as the south slopes; they are more moist and can support more plant cover. Often in these habitat types, the shade produced by the trees is so dense that even the extremely shade-tolerant western hemlock cannot grow. This denser tree canopy also limits the amount and species variety of understory plants. Although these north-facing slopes are wetter than the south-facing slopes, they will burn during very dry summers such as the summer of 1988. For this reason, Douglas-fir dominates all these stands even though western hemlock would finally prevail if there were no disturbance. Further evidence of past fire history on these north-facing slopes can be seen by the structural and age-class diversity of the forest stands growing there. Big-leaf maple and black cottonwood also occur in the canopy occasionally along major riparian areas although big-leaf maple is a common understory tree throughout the analysis area.

A Pacific silver fir, climax type that occurs above 4,000 feet on the slopes of Wolf Mountain, is one other major vegetation type occurring on the analysis area. This forest type represents only about 1 percent of the analysis area.

FOREST STAND STRUCTURE

Timber harvesting activities have been occurring in this area over the past 50 years. About 35 percent of the analysis area is composed of Douglas-fir plantations from 1 to 50 years old. Trees in these areas are from 1 to 75 feet tall, and the plantations are usually well stocked with the exceptions of those that were burned. About 2,675 acres (1,795 National Forest and 880 Private) of these plantations were burned during the Shady Beach fire. Another 25 percent of the area is occupied by plantations which were not affected by the fire. Most of these plantations in and out of the fire boundary have moderate amounts of woody debris on the ground with the exception of those which experienced the most severe fire. None of these plantations contain residual mature trees that would provide for future stand diversity.

The remaining area is composed of a diverse matrix of stands from about 80 to 400 years old. These were all created or modified by recurring fires. Even the younger stands, that filled in areas of past fire mortality, have scattered large trees within them which have survived the last catastrophic fire.

Old-Growth

Most of the stands over 200 years of age have a diverse stand structure with numerous standing dead trees of various heights and diameters. Most of these stands contain a moderate amount of down trees. Approximately 21 percent (4,640 acres of the analysis area) can be described as forest stands consisting of predominately old-growth trees as defined by Franklin and others (1981) in their publication "Ecological Characteristics of Old-growth Douglas-fir Forests". These stands contain trees greater than 36 inches in diameter, at least several snags per acre, abundant down woody material, deep tree crowns, and a multi-storied canopy from the development of climax tree species. Most of the burn area which experienced moderate-to-severe fire intensity no longer exhibits some or most of these old-growth characteristics. There are about 1,600 acres within the fire area that could be considered old-growth. The fire consumed or partially consumed snags and down logs, and tree-falling associated with the suppression efforts has removed many of the defective trees. These would have become snags in the near future even if the canopy trees had not been killed.

REFORESTATION

The dry, south-facing slopes in this area present a challenge to the silviculturist when it is time to consider harvest and to reforest the Douglas-fir climax stands. The herb and brush layer under these stands contain several species that can provide very intense competition to tree seedlings if the competing vegetation is allowed to develop faster than the trees. Primary among these competitors are various species of grass, two species of ceanothus, Pacific madrone, manzanita, and chinquapin. The narrow time slot available for effective planting on these harsh sites adds to the reforestation problem. During the winter, the fine-textured soils that often occur in the analysis area can be too wet to plant. They also can dry rapidly when the winter rains stop.

The direct effects of solar radiation can also be a problem on these south slopes. Direct sunshine can heat bare soil to the point that it can damage tissue under the bark of a seedling around the root collar and the increased leaf temperatures can increase the evapo-transpirational demand to the point that the seedling can become moisture-stressed even when soil moisture is not low.

The fire has created certain conditions that aggravate these reforestation problems. On steeper slopes that are now subject to soil raveling, seedlings can be partially buried by soil particles moving downhill. In areas where all organic material has been consumed, especially in former plantations, there is no material or vegetation that can produce shade to protect seedlings. In addition, the lack of a litter layer, which can act as a mulch, may expose seedlings to higher soil temperatures and greater moisture-stress.

DETERIORATION OF FIRE-KILLED TREES

There is some amount of uncertainty as to how quickly economic value and volume losses due to weathering, insect damage, and fungal decay will occur in fire-killed trees. Weathering occurs mostly in thinner barked trees and in the smaller diameter portion of larger trees as a result of the bark cracking and allowing the interior of the tree to dry out. This causes cracking which severely reduces the tree's value for lumber, but the wood can still be used to make chips if it has not been charred. Insects may tunnel into the cambium, sapwood, and eventually into the heartwood of the tree. This causes a loss in economic value but there is no volume loss until advanced stages of the infestation. The Silviculture Paper in Appendix C contains more information on the effects of wood-boring insects. Boring insects, adults and larvae of several beetle species, often function as spreading agents for a variety of fungi by providing a path for the fungus to enter. Fungal infection causes most of the loss of volume and, over a period of several years, can render the sapwood of nearly all species economically valueless. The heartwood of western hemlock is also very susceptible to fungal decay and may also be rendered valueless in several years. In several more years, the heartwood of sugar and ponderosa pine can also be significantly affected. The heartwood of large diameter Douglas-fir can last somewhat longer than this, and western redcedar may last decades. For more detail on how quickly trees will deteriorate, see Appendix C.

THREATENED, ENDANGERED, AND SENSITIVE PLANTS

There are no known occurrences in this area of any plants Federally listed as endangered or threatened. The State of Oregon, in a report published yearly by the Oregon Natural Heritage Data Base (1987), designated plants that are considered to be threatened, endangered, or sensitive within the State although some of these plants may be fairly common in other states. The U.S. Forest Service Region 6 Sensitive Plant List, (USDA Forest Service 1988g) which is also published yearly, is based upon the Oregon list of Threatened, Endangered, or Sensitive species. New additions to the Oregon State list are designated as potential additions to the Regional list which indicates a need for more complete information on a particular plant.

No species on either of these lists have ever been located within the project area boundary but there are several species that have been found elsewhere on the Willamette National Forest in habitats similar to those that occur in the analysis area. Most of those species tend to occur in special, relatively uncommon non-forest vegetation types. *Polysticum californicum*, a species of sword fern generally found south of the Willamette National Forest is known to occur on rock walls and cliff ledges. A harebell called *Campanula scabrella* is known to occur on dry talus slopes. An aster, *Astor gormanii*; *Phacelia verna*; Thompson's mistmaidens, *Romanzoffia thompsonii*; a small fern, *Pellaea anadromedaefolia*; the Sierra onion, *Allium campanulatum*; and spleenwort, *Asplenium septentrionale* may occur in the, dry rock garden or meadow types previously described. Two clubmosses, *Lycopodium inundatum*, *Lycopodium annotinum*, and adder's tongue, *Ophioglossum vulgatum* could occur in the limited marsh and bog habitat in the area. A blue-eyed grass, *Sisyrinchium sarmentosum* and a checker mallow, *Sidalcea setosa* may occur in moist meadows. All the above plants occur in non-forest vegetation types which are fairly uncommon in the analysis area. Only about 153 acres of the fire area is occupied by mappable meadows, rock outcrops, marshes, and bogs. Of these plants, the blue-eyed grass, the checker mallow, and the Phacelia have been found elsewhere on the Rigdon Ranger District.

One other species could possibly occur in forested areas that is on the regional list as a potential candidate for sensitive status. *Frasera umpquaensis*, a member of the gentian family, occurs in moist areas of high elevation forests and subalpine openings. This habitat is found in limited areas around Wolf Mountain and the headwaters of Warfield Creek.

FIRE AND FUELS

FIRE HISTORY

As mentioned in the Vegetation section, past wildfire occurrence has been relatively frequent and has played a large part in creating the stand structure and to a certain extent in determining the amount of fuels in the analysis area prior to the Shady Beach fire. Prehistoric fires burned more often than has generally been thought as discussed by Teensma (1987). Non-lethal fires were more frequent than the 78-year return period for south slopes calculated by Teensma based upon fire scars recorded in tree-ring chronology. There are 80-year-old stands in the analysis area that regenerated after relatively recent natural fires. The fuel loading in these areas was kept at low levels as the build-up of litter, branches, and dead trees was partially removed periodically by these fires.

Fire control efforts have interrupted the natural process of fuel removal by frequent, low-intensity fires. Consequently, fuels in unmanaged stands have accumulated to the point that high-intensity fires will become more frequent. Approximately 30 percent of the analysis area has reduced fuel loadings resulting from fuels treatments after harvesting.

The analysis area is located in a fire occurrence zone that has an annual occurrence of two lightening and two human-caused fires per year (a 15-year average from Rigdon Ranger District fire ignition records). The annual lightening-fire frequency is 0.125 fires per 1,000 acres; this is considered to be quite high.

FUEL LOADING

Current fuel loading in unmanaged stands is quite variable within and outside of the fire areas due to the complex fire history of the area and the varying degrees of recent fire intensity. Fuel loading in mature stands that were not burned ranges from 17 to 99 tons per acre. Fuel loading in unmanaged, burned stands ranges from 5 to 55 tons per acre where the burn intensity (vegetative mortality classification) was high. In second-growth stands that were treated for fuels reduction and site preparation after harvest, fuel loading may range from 10 to 45 tons per acre where the burn intensity was high. In areas of lower intensity, fuel levels may have been reduced only a small amount from pre-fire levels.

Fuel loading in a harvested area where there has been no yarding of unmerchantable material can be as high as 106 tons per acre but averages about 45 to 70 tons per acre. Loading in treated harvest units generally will have about 45 tons of fuel per acre remaining.

Fuel Accumulation

Fuel loading is dynamic, highly variable, and difficult to predict over time. The use of comparative, standardized models is essential in communicating fuel conditions. The Northern Forest Fire Laboratory (NFFL) has developed a set of models to serve as a standardized reference for fuel types and resultant fire behavior. These are described by Anderson (1982) in a pictorial format. The representative fuel model in the light-to-moderately burned areas of the analysis area in an NFFL Fire Behavior Fuel Model 8. This type of fuel is composed of a thin layer of twigs and needles that have fallen from damaged or killed trees and typically contains 5 tons per acre of fine fuels that can carry a fire. This fuel type would present suppression difficulties only under the most extreme of weather conditions.

Unburned, unmanaged stands in the analysis area are typified by NFFL Model 10. This type of fuel would typically contain about 12 tons of fine fuel per acre, although there may be much greater amounts represented by large diameter fuels. Wildfire in this type of fuel can consume tree crowns, spot, and is difficult to fight directly in all but the most favorable weather conditions.

FIRE BEHAVIOR

Potential future fire behavior is a function of the seasonal variations in the climate, the precipitation occurring in an area over the summer, and the specific conditions of humidity, fuel moisture, wind speed and direction, and temperature in conjunction with the amount, size, and arrangement of fuel on the ground. Since all of these factors except for fuel conditions vary considerably from year-to-year and even from day-to-day, the following discussion on potential fire behavior will center around fuel-loading changes. These changes become more significant as weather conditions favor the ignition and spread of fire.

Potential fire behavior in the near term has been reduced from what it would have been without the Shady Beach fire effects. Areas burned with a low or moderate intensity have a reduced fuel-loading of fine fuels which are critical in fire ignition and spread. Areas that were intensely burned (although there may be still a great amount of standing material) have little to no fine fuel accumulation on the ground so there is little chance of carrying a fire that may start in these areas. As time passes, these conditions will change, especially in those areas that were burned severely enough to kill the tree canopy. As the dead trees deteriorate, large amounts of fuel will accumulate on the ground as needles, limbs, and tree boles fall. The high density of snags in the fire area and their broad dispersion will contribute to potential for long-range spotting, and, therefore, to a greater amount of fire-spread potential. An increase in the density of snags in the fire area may also increase the number of lightening-caused ignitions.

For comparison purposes, fire-behavior predictions based on typical late summer afternoon weather conditions in the analysis area were developed for the array of fuel models described above and is displayed in Figure III-10. The forward rate of spread relates to the fire's ability to spread through a continuous fuelbed.

FIRE BEHAVIOR

Fuel Model	Forward Rate of Spread	Projected Size After 1/2 Hour	10-Acre Containment
8	3 chains per hour	0.1 acres	Yes
5	13 chains per hour	1.3 acres	No
11	10 chains per hour	0.7 acres	Questionable
10	10 chains per hour	0.8 acres	Questionable

Figure III-10 Fire behavior based on Fuel model

The projected size after one-half hour assumes that the weather, fuels, and topography remain constant for this period and that no suppression efforts are initiated. The 10-acre containment test is an assessment as to whether initial attack forces in sufficient numbers could get to the fire in time to contain the fire at 10 acres or less.

WILDLIFE

The analysis area provides habitats for a wide variety of animal species that can be considered typical of western Cascade Douglas-fir forests. A complete description of species occurrence and habitat trends on the Willamette National Forest can be found in the Affected Environment section, page III-69, of the Proposed Forest Plan/DEIS for the Willamette National Forest. The diversity of animal species is greatly influenced by the structural diversity of the forest stands which has been created both from the past fire history and management of the forest in the analysis area. Management of the forest has resulted in a wide range of diverse habitats through its influence upon vegetation successional stages.

The analysis area provides winter and summer habitat for Roosevelt elk, black-tail deer, cougars, black bear, coyotes, and numerous small mammals. The many bird species inhabiting the analysis area include osprey, bald eagle, northern spotted owl, various other raptors, great blue heron, Canadian geese, and various species of ducks, several species of grouse, and a large variety of perching and cavity-nesting birds. Many different species of reptiles and amphibians also inhabit the area. See the Fish section of this Chapter for more discussion on the fish species inhabiting the area.

BIG-GAME HABITAT

The analysis area provides both winter range and summer range habitat for Roosevelt elk and black-tail deer. The winter range provided within the analysis area is a particularly important and limited resource. In part, this is due to the loss of about 2,000 acres of valuable winter range that was eliminated with the construction of the Hills Creek Reservoir and in part due to the fact that the site of the City of Oakridge was once part of this low-elevation winter habitat.

An important characteristic of the older forest stands within the winter range is the multiple-layered canopies typical of these forest types that provide effective thermal cover. These multi-layered canopies provide effective thermal cover by moderating seasonal and daily temperature changes. This type of thermal cover also reduces snow accumulation on the forest floor which allows for the increased availability of forage plants such as lichens and understory brush.

Critical winter range is a portion of the winter range where animals seek protection during the worst of winter storms and deep snow fall. This essential habitat occurs in the lower elevations of the analysis area. It is generally located on the lower, south-facing slopes directly above the Hills Creek riparian area and on the slopes directly above the Hills Creek Reservoir. Within the winter range of the analysis area, there are two separate herds of elk. One herd includes about 100 elk and winters on the south-facing slopes directly north of Hills Creek. These animals migrate to the Diamond Peak area in the late summer and tend to use the Wicopee area of the Salt Creek drainage in midsummer. The other herd of elk, numbering about 60 animals, winters south of Hills Creek in the Willow Creek and Bull Creek drainages, spending the summer between Groundhog and Tufti Mountains. Smaller groups from this herd use the winter range year-round.

Natural mortality of these herds has not been studied. Both herds appear to be growing slowly in numbers which would indicate that mortality is not above normal levels. Normal mortality would be around 10 to 15 percent of the population per year. This elk range has an abundance of hiding and thermal cover to avoid the heavy hunting pressure that occurs due to the extensive road network in these areas. Elementary data suggests that poaching on these two wintering herds may be the greatest "hunting" effect.

Road use, whether from logging, recreational activities, or hunting is the main human activity besides hunting that has the largest effect on these elk herds. Disturbance by road traffic increases stress on the animals by causing them to expend energy and driving them away from forage. This type of disturbance also results in underutilization of forage that is not close to effective hiding cover.

Deer inhabit the area during winter and summer in estimated densities from 20 to 30 animals per square mile (Ferry 1988). The Shady Gap area, with its mosaic of older stands and plantations provided ideal habitat for deer before the fire occurred. The deer population increases in this area during the winter as deer move down from the Wolf Mountain area. Deer use the same winter range and critical winter range areas as do the elk. Summer range consists of about 17 percent of the analysis area.

Since most of the analysis area is winter range habitat, forage/cover ratios are presented only for winter range throughout the document. Forage/hiding cover/thermal cover ratios for the overall analysis area are 48 percent forage, 15 percent hiding cover, and 37 percent thermal cover. Figure III-11 shows forage cover relationships for each subwatershed. Within the fire area there is 59 percent forage, 11 percent hiding cover, and 30 percent thermal cover. Hiding cover was greatly reduced within the burn area, especially in the Shady Gap area north of Hills Creek where 20- to 30-year-old conifer plantations offered ideal concealment areas adjacent to younger plantations containing abundant forage.

BIG-GAME FORAGE/HIDING/THERMAL COVER

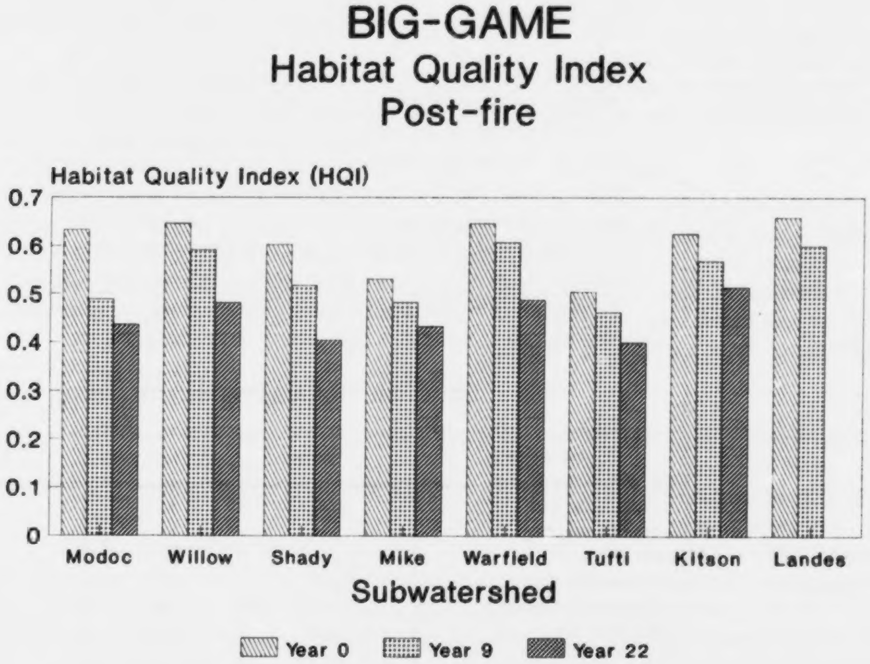
Subwatershed	Forage	Hiding Cover	Thermal Cover
21A Modoc (F)	37%	10%	53%
22D Warfield (F)	30%	15%	54%
21B Willow	25%	36%	39%
22R Landes (F)	39%	21%	40%
22B Shady Gate (F)	54%	8%	41%
22C Mike (F)	62%	12%	26%
22P Tufti (F)	83%	7%	10%

(F) indicates subwatersheds affected by the fire.

Figure III-11 Big-game Forage/Hiding/Thermal Cover by subwatershed

To maintain an even flow of these habitats over time, The Willamette National Forest guidelines are to maintain 20 percent forage, 30 percent hiding cover, and 50 percent thermal cover within big-game winter range. These percentages are calculated for a 100-year harvest rotation. As shown, all the subwatersheds do not meet the recommended 20 percent forage and only two meet the recommended 50 percent thermal (thermal plus optimum thermal). The abundance of forage will be beneficial during spring, summer, and fall. However, when winter snows cover the forage commonly available in the open areas, deer and elk are dependent on the small amount of forage that is found under the canopy of the thermal cover.

Habitat Quality Index (HQI) measures the distribution and size of forage and cover areas, the quality of the forage and cover, and the amount of disturbance by road traffic. A rating is generated to express the quality of this habitat. HQI can range from 0 to 1, with 1 representing the highest effectiveness for maximizing big-game production. These values for subwatersheds within the analysis area are presented in Figure III-12. Currently the analysis area has a habitat viability of 0.61, or highly viable for big-game populations, but in 22 years, the viability would decline to 0.39, or marginally viable. This decline would be a result of the forage areas maturing from forbs, grasses and shrubs to tall shrubs and trees becoming cover habitat.



• HQI • 0.0 for yr. 22 in 22R

Figure III-12 Big-Game Habitat Quality Index (HQI), post-fire

Both black bear and cougar are relatively abundant in this area. No site-specific population counts exist for either species but population trend information indicate that these populations are healthy and stable (Castillo 1988).

BIRDS

The analysis area contains habitat for numerous species of birds. Grouse and quail are common, especially in the mosaic of plantations and mature stands of the Shady Gap area. Some migratory waterfowl use the Hills Creek Reservoir during the migration season and some 30 Canadian geese nest along the reservoir shoreline. Duck nesting has also been observed along the reservoir as well as several pairs of osprey. Two osprey nests are within the analysis area on the eastern shore of the reservoir, and another is located in the Hills Creek arm of the reservoir just outside of the analysis area.

Generally speaking, the fire has removed cover and nesting sites for terrestrial birds and thereby has reduced habitat value during the first winter and early spring after the fire.

A pair of barred owls, which are not native to the Pacific Northwest, also inhabit a portion of the former spotted owl habitat area (SOHA) described in forthcoming pages. This species has been known to compete with and replace the spotted owl in areas where habitat has been fragmented. The fire effects have enhanced the habitat for the barred owl.

The area also contains bald eagles and northern spotted owls which are discussed in the Threatened, Endangered, and Sensitive Species section of this Chapter.

OLD-GROWTH HABITAT

Pileated woodpeckers and pine martens are indicators of mature and old-growth forest habitats. The pileated woodpecker is the largest of the many birds that use snags and defective trees as nesting and feeding habitat. Areas that contain pileated woodpeckers will also support a larger number of smaller woodpeckers and various other birds and mammals that use abandoned woodpecker cavities for nesting and shelter. Pine martens use dead and defective trees for denning and foraging and rely heavily on down log habitat for foraging. As with pileated woodpecker areas, areas that are adequate to contain pine martens will also support the larger number of prey species that use mature and old-growth habitats.

A 300-acre pileated woodpecker habitat area (PWHA) is designated in the Bull Creek drainage. Another PWHA was designated in the Shady Gap area. These were to serve as management indicator areas for mature and old-growth habitats. The Shady Beach fire impacted the Shady Gap PWHA so that it no longer has adequate habitat acres. The remaining, unburned habitat acres in the Shady Gap area have been designated as a 160-acre pine marten habitat area (PMHA).

The northern spotted owl is also an indicator of mature and old-growth forest habitats. The spotted owl has been designated as a sensitive species and has been identified in the analysis area. Discussion pertaining to the northern spotted owl can be found under the threatened, endangered, and sensitive species section throughout the document.

INTERIOR FOREST SPECIES HABITAT

Interior species such as the red-backed tree vole, northern flying squirrel and the Oregon slender salamander, are those that prefer interior old-growth forest conditions for survival or reproduction. Past management activities, site productivity, and fire have affected the amount and quality of interior forest habitat in the Shady Beach fire area.

An Interior Habitat Index (IHI) was developed for the analysis which measures the quality of stands as they relate to habitat of interior forest habitat-dependent wildlife. This index takes into account forest stand size, age, canopy structure, and amount of large woody material present. For all forest stands that have the potential for providing some level of interior forest-dependent species habitat (those greater than 50 years old), a rating is generated to express the quality of that habitat. This rating is a number from 0 to 1, with 1 representing the highest quality interior forest habitat. Total acres that have potential interior habitat are presented in Figure III-13. For more complete information on the calculation of the Interior Habitat Index values, refer to the Wildlife Process Paper on Interior Habitat Index in Appendix E.

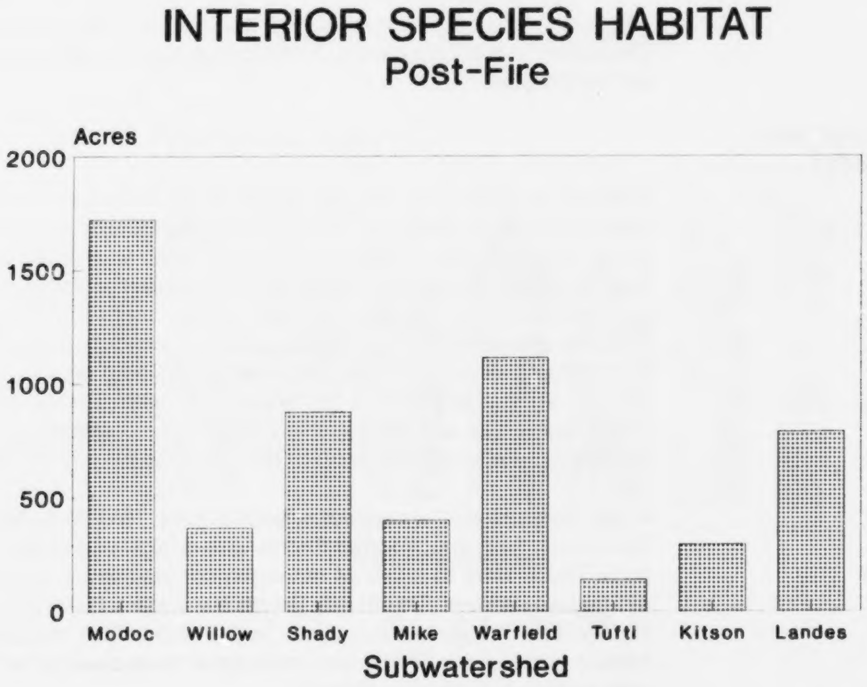


Figure III-13 Interior Species Habitat by subwatershed, post-fire

DEAD AND DEFECTIVE TREE HABITAT

Dead and defective trees (principally snags and down logs) provide essential habitat for many species of birds, mammals, reptiles, and amphibians. Current Forest Service Region 6 direction is to manage dead and defective habitat to maintain effective populations of primary cavity excavators (woodpeckers) in excess of 40 percent of their potential population capacity. By managing dead and defective habitat at a greater than 40 percent level, we are assuming that we will be maintaining greater than 40 percent of the population levels of those species dependent on this habitat.

Past harvest activity did not retain enough dead and defective habitat to meet current direction on those managed acres. Figure III-14 shows the existing percentage of potential population capacity on the subwatershed acres which have not been harvested. Most soft snags (Stages 3, 4, and 5) were lost, as well as many of the deteriorating hard snags (Stages 2 and 3) (See Glossary for Snag definitions). Approximately 50 percent of the hard snags created by the fire have heart-rot which may require about 3 to 5 years for the exterior wood to deteriorate before they are suitable for woodpeckers to excavate cavities.

DEAD AND DEFECTIVE HABITAT
Percentage of Potential Population Capacity
for Primary Cavity Excavators

Subwatershed	Hard Snags 5-30 yrs	Hard Snags 31+ yrs*	Soft Snags 0-30 yrs	Soft Snags 30-60 yrs	Soft Snags 60+ yrs
21A Modoc (F)	86.5%	74.0%	21.4%***	86.5%	74.0%
21B Willow	39.8%**	39.8%	39.8%	39.8%	39.8%
22B Shady Gate (F)	78.9%	58.5%	26.3%***	78.9%	58.5%
22C Mike (F)	52.5%	34.6%	26.3%***	52.5%	34.6%
22D Warfield	55.5%	55.1%	55.1%	55.5%	55.1%
22Q Kitson (F)	70.8%	67.3%	42.5%***	70.8%	67.3%
22R Landes (F)	52.4%	49.0%	39.3%***	52.4%	49.0%
22P Tufti (F)	74.3%	33.7%	7.4%***	74.3%	33.7%

(F) indicates the subwatersheds affected by the fire.

* The percentage decrease in the hard snags in the 31+ years column reflects those acres of total fire kill. When these fire-killed trees move from hard snags to soft snags, there will not be trees to replace the hard snags.

** Subwatershed 21B (Willow), which was not affected by the fire, is below the Regional Direction with 39.8 percent of potential population capacity remaining.

*** The potential population capacity for soft snag cavity excavators based on the availability of soft snag habitat remaining in the unburned portions of the subwatersheds.

Figure III-14 Dead and Defective Habitat, percentage of potential population capacity for primary cavity excavators

RIPARIAN-DEPENDENT SPECIES

Riparian areas are used more intensively by wildlife than would be suggested by the small percentage of this habitat type in a typical landscape. Some species use this habitat almost exclusively. Water ouzels (dippers), mink, and fish species are some of these riparian-dependent species, but the most numerous species found in these environments are amphibians and various invertebrates that form the food base for the larger species. The fire has had a profound effect on some of these species in the smaller streams. Increased sediment due to ground cover loss tends to coat the stream rocks. This reduces or eliminates the algae and moss which are an important food base. Sediment also fills and buries the crevices under rocks and logs which are important habitat niches for amphibians and other aquatic-dependent species.

THREATENED, ENDANGERED, AND SENSITIVE SPECIES

The bald eagle is the only Federally threatened bird species found in the analysis area. A pair of bald eagles nest outside the fire area. They use the reservoir for foraging and trees along the reservoir for perching. The reservoir and river system contain enough foraging habitat to support two additional pairs of bald eagles. Two areas on the Rigdon Ranger District have been designated as potential eagle nesting areas, or bald eagle management areas (BEMAs). The lower end of the Bull Creek drainage adjacent to the reservoir is one of these designated areas, although no nesting pairs of eagles occupy this area at this time. The fire has had little effect on the suitability of this BEMA. The area was underburned but experienced only patchy tree mortality so numerous potential roost and nest trees still exist. Management direction for this area is to retain and promote the area's suitability for nesting, roosting, and perching. Management direction for the rest of the reservoir shoreline and the Hills Creek riparian area is to retain suitable perching trees within 200 feet of the shoreline or roadway (Hills Creek Bald Eagle Management Plan 1983).

Sensitive species are those species for which the Pacific Northwest Region of the Forest Service has identified a population viability concern. Usually this concern is identified as the result of the State designating a species as threatened or endangered which has happened with the northern spotted owl. There are three pairs of spotted owls living in the analysis area but no nesting has been observed. Two of these pairs were discovered during July of 1988, but their territories have yet to be identified. The behavior of these two pairs indicated that they were not nesting at the time of observation. Both pairs were occupying fragmented habitat due to past fire history and recent timber harvest.

The third pair of spotted owls has occupied the Bull Creek drainage. This area had been designated by the Proposed Forest Plan/DEIS as a spotted owl habitat area (SOHA) as part of the spotted owl habitat network prescribed in the Region 6 Spotted Owl Guidelines contained in the Supplement to the Pacific Northwest Regional Guide (USDA Forest Service 1988f). The last confirmation of the female's presence was in 1986 which was a non-nesting year for this pair. The Bull Creek SOHA included 2,200 acres of suitable habitat prior to the Shady Beach fire. Suitable spotted owl habitat is defined as mature or old-growth forest with multiple-canopy layers and a 70 percent or greater canopy closure. The fire has reduced the amount of suitable habitat to 971 acres. This reduction in habitat suitability is due to the loss of the multiple-canopy layers, reduction in canopy closure and loss of other structural habitat components such as snags with cavities and deteriorated logs, which provide habitat for important prey species.

Due to these fire effects, the Bull Creek SOHA does not meet Regional guidelines for spotted owls habitat since at least 1,500 acres of suitable habitat is required for each SOHA. As a result, the Bull Creek SOHA has been deleted from the SOHA network. Other areas that contain an adequate amount of habitat are being evaluated for their ability to fit into this SOHA network. These areas are outside of the analysis area and they will be evaluated in the Proposed Forest Plan/DEIS.

Other than the bald eagle and the northern spotted owl, there are no other threatened, endangered, or sensitive species presently known in the analysis area, but there is potential habitat for several other species listed as endangered or sensitive. There are small amounts of cliff habitat that have the potential to provide nesting ledges for peregrine falcons, a Federally listed species. Numerous small ponds within the fire area were field checked and determined to be unlikely as habitat for the spotted frog, Oregon chub and western pond turtle, which are listed as sensitive by the U.S. Forest Service. Another sensitive species, the one-spot rhyacophilan caddisfly, is known to inhabit a high elevation tributary to Hills Creek about eight miles from the analysis area. Whether this caddisfly occurs within the analysis area is unknown at this time.

CULTURAL

Cultural resources are the remains of human occupation or activity in the form of artifacts, sites, structures, or other features that were of importance in human events, both historic and prehistoric. These resources are the record of past human use of the Forest. This record provides information about a way of life that lasted much longer than recorded human history in this area. Little is known of the people that lived here before European settlers moved into the area to farm and harvest timber. These native people may have lived year-round near the city of Oakridge. We do know that the Rigdon Ranger District area was used seasonally from spring to fall. These people may have traveled from permanent villages in the Willamette Valley and east of the Cascade Mountains. The Native Americans who lived in this region succumbed to various diseases before Euro-Americans arrived to record their culture. The remains of their camps and tools are important, since they are our only source of knowledge of these people. The value of these resources lies in their potential for providing information about former ways of life and its historic significances to the community in which they now exist.

There are 25 inventoried prehistoric sites in the analysis area. All these sites are estimated to date from prehistoric times to about 2,500 years ago. They are all classified as lithic scatters, sparse accumulations of stone tools, and fragments that are buried below the surface of the soil. It is thought that all these sites represent hunting and gathering camps since no indication of any permanent dwellings have been found.

Of the 25 sites, 10 are located within the fire area. Of these 10, eight have been disturbed by previous road-building or timber-harvest activities. The undisturbed condition of the remaining two sites is enough to make them eligible for the National Register of Historic Sites. The fire had no effect on these sites except to expose the surface material to a small amount of raindrop impact which will be eliminated by the quickly developing vegetation.

There are no known historic cultural resources located in the analysis area except for the old Central Oregon Military Wagon Road and a homestead site located at the bottom of Hills Creek Reservoir.

RECREATION

The recreation activities that occur on the analysis area are diverse. They range from use of the developed campground and boating facilities at Packard Creek Campground to the dispersed use of the area for driving and hiking for pleasure.

DEVELOPED RECREATION SITES

Packard Creek Campground, the largest developed recreational facility in the area, is located on the west shore of Hills Creek Reservoir, about 7 miles on paved roads from Oakridge. It is a full-service, fee campground and day-use area that also has a protected swimming beach and a year-round boat ramp. The campground receives about 13,100 visitor days-per-year and is usually full to overflowing on holiday weekends and most weekends from the Fourth of July through Labor Day. The picnic area, beach, and boat ramp receives another 12,000 visitor days-per-year. This area is mostly used by the Oakridge and Westfir population and, to a lesser extent, by people from the Eugene/Springfield area. Much of the eastern shore of the reservoir that can be seen from Packard Creek Campground is within the fire area.

The C.T. Beach picnic area and boat ramp is located at the head of the Hills Creek arm of the reservoir. It provides five picnic sites and a boat ramp that is usable only when the reservoir is at its higher levels. The managed season is from April 15 to October 15, and the estimated use in 1987 was 1,900 recreation visitor days. Portions of the fire area are visible from this picnic area.

The Cline Clark picnic area is located on the western shore of the reservoir, north of the Packard Creek Campground. This day-use area contains three picnic sites, and the estimated 1987 use was 25 recreation visitor days. Most of the eastern shore of the reservoir that can be seen from this picnic area is within the fire area.

DISPERSED RECREATION

Most dispersed recreation in and around the planning area involves hunting, hiking, driving, fishing, and, to a certain extent, firewood-cutting. Hunting includes deer, elk, bear, and upland game birds, such as grouse and some waterfowl species.

Firewood-cutting in the planning area is sometimes reserved for the senior citizen members of the local community due to the close proximity to the City of Oakridge. Firewood-cutting can be considered a family affair as well as a stress-reducing activity for some individuals.

Fishing is open year-round on the slack-water portions of the Hills Creek Reservoir. Fishing from the bank and from boats is popular during the late fall and early spring near the inlets of Hills Creek, Middle Fork of the Willamette River, C.T. Beach, Hills Creek Dam, and the Packard Creek Campground boat ramp. Stream-fishing takes place in Hills Creek during the regular open season. The Oregon Department of Fish and Wildlife regularly stocks the lower portions of Hills Creek.

Hiking activities largely occur on the Tufti Creek Trail #3624 (Tufti Creek Trail is 0.5 miles in length) which parallels Hills Creek near Kitson Hot Springs. During fire-fighting activities some hazard trees were fallen across the Tufti Creek Trail, but these trees have since been removed from the trail. One other trail, the Kitson Ridge Trail #3606, has its southern trailhead on the north edge of the planning area. The Kitson Ridge Trail was not affected by the fire. Both of these trails are in the low-to-moderate use category.

Driving is another popular use. The 1988 vehicle counts show approximately 78,980 vehicles used on Forest Road 21 between Hills Creek Dam and the upper end of the reservoir for recreation purposes. In addition, 1988 vehicle counts show approximately 6,615 recreational vehicles used Forest Road 23. Thirty percent of this recreational vehicle traffic is associated with the use of C.T. Beach.

Other activities related to water that occur in the analysis area include water skiing, wind-surfing, and sail-boating.

VISUALS

National Forest scenic beauty is a valuable resource. The quality of the Shady Beach Fire Recovery Area's scenic resource is important primarily to recreationists. Portions of the analysis area visible from Forest Roads 21 and 23 and the reservoir, have been designated in both the Current Forest Plan/FEIS and the Proposed Forest Plan/DEIS as areas where a certain degree of scenic quality will be maintained. The analysis area along the east side of the reservoir is part of the Middle Fork viewshed.

There are views of the analysis area from several critical viewpoints along Forest Road 21. The reservoir, framed by the hillsides, is the focal point of recreational activities. A recent Middle Fork viewshed survey, "Middle Fork Willamette Viewshed Corridor Study" (Stix 1988), contains pre-fire information on the condition and characteristics of this scenic area. This study characterizes the reservoir and associated landscape as horizontal ridges covered with dense conifer forests. The roadside vegetation on Forest Road 21 consists of second-growth hardwoods and conifers interspersed with small stands of old-growth Douglas-fir.

The Proposed Forest Plan/DEIS visual management land allocation specifies Visual Quality Objectives (VQO) of retention in the foreground along Hills Creek Reservoir and partial retention in the middleground to the north for areas affected by the fire. There is a segment of modification middleground to the south that is part of the project area, but was not affected by the fire. The VQO for outside the visual allocation is maximum modification (see Glossary for description). There is also a small segment of the Middle Fork viewshed north of Forest Road 23 with a VQO for modification and a small segment of the Highway 58 viewshed along the top of Kitson Ridge with a VQO for partial retention. Neither of these segments should be affected by the recovery project.

The Current Forest Plan/FEIS designates a partial retention VQO for the lands adjacent to Hills Creek Reservoir and along Hills Creek road. This plan refers to this allocation as "Scenic II". The difference between the two plans is primarily in the amount of area designated for meeting retention and partial retention VQOs, with the proposed plan providing more visual land allocation than the current plan. Specific VQOs for these land-use allocations are identified in the current and proposed forest plans. Guidelines have been established for managing the visual quality of areas seen from Forest Road 21 and recreational sites. The visual quality objectives and guidelines for these areas can be found in the Current Forest Plan/FEIS on pages 285, 428, and 495 and in the Proposed Forest Plan beginning on page IV-142. Figure III-15 outlines the objectives and standards for the areas potentially affected by the recovery project. The analysis file contains a map of the visual management land allocations for both plans.

The fire left natural patterns on the landscape. This is considered a natural process, even though it it cot certain that the fire was started by natural causes and is not a visually degrading disturbance. The fire burned primarily on the ground and at times the ground fuels and winds allowed the fire to get up into the tops of the trees which resulted in singing or burning the tops of individual trees or groups or trees. This resulted in a mosaic of new colors, textures and lines of black snags in combination with the remaining live vegetation. Thus the fire has created a new, natural landscape. Activities which result in deviations from the new pattern are the elements which must be judged against the adopted visual quality objectives identified in the Proposed Forest Plan/DEIS.

VISUAL QUALITY OBJECTIVES
IN THE
SHADY BEACH FIRE RECOVERY ANALYSIS AREA

Visual Quality Objective (VQO)/location	Description	Measurable Standards And Guidelines
RETENTION/foreground	Alterations of the natural landscape will not be visually evident to many observers. Activities within this management area may only repeat form, line, color, or texture elements which are frequently found in the characteristic landscape. Visual contrast of management with these elements will be minimized through manipulation of the shape, edge effect, scale, and distribution of resource treatments.	5% Maximum Harvest Rate Per Decade. 5 Acre Maximum Opening Size
PARTIAL RETENTION/ middleground	Alterations of the natural landscape will remain visually subordinate. Activities within this management area may repeat form, line, color, and texture elements common to the characteristic landscape. Visual contrast of management with these elements will remain subordinate through manipulation of shape, edge effect, scale, and distribution of resource treatments.	10% Maximum Harvest Rate Per Decade. 15 Acre Maximum Opening Size

Figure III-15 Measurable standards and guidelines for visual quality objectives in the Shady Beach Fire Recovery analysis area.

DEVELOPMENTS AND IMPROVEMENTS

There are a number of developments in the analysis area, several of which are located on private land. The most extensive development is the road system that has been used for past and present forest management on public and private land. This road system totals about 129 miles and accesses 48 percent of the analysis area. Approximately 7.5 miles of these roads are on the private land owned by Pope & Talbot, Inc.

The next largest development in the area is the Hills Creek Dam and Reservoir. The dam is about 350 feet high and impounds a reservoir that covers 2,700 acres at full pool with a useable water storage of 234,300 acre feet. All the associated power generation facilities are just outside of the analysis area.

Camp Huntington, a Boy Scout camp located on 160 privately-owned acres around Kitson Hot Springs, is near the head of the Hills Creek arm of the reservoir. This camp contains numerous buildings as well as the developed hot-spring facility.

A short portion of the Southern Pacific Railroad right-of-way crosses the northeast corner of the analysis area in the vicinity of Shady Gap. This railroad route goes over the Willamette Pass via the Salt Creek drainage but comes across Shady Gap on one of the switchbacks needed to gain elevation. This stretch of track totals less than 1 mile in length and a portion of this is within a tunnel. The Southern Pacific Railroad maintenance station at Fields, which consists of several residences and maintenance buildings, is also near the Shady Gap area, but this facility is just outside of the analysis area boundary.

On the summit of Wolf Mountain at the extreme eastern end of the analysis area, there is an electronics site that provides two-way radio communication for 12 private businesses, individuals, and public agencies, including the Oregon State Police. This site contains several buildings, housing radio equipment as well as numerous exterior antenna towers. Power is supplied to the site through underground lines that do not cross the analysis area.

In addition to these private site-specific developments there are also the Packard Creek Campground and Cline Clark and C.T. Beach day-use sites administered by the Rigdon Ranger District which are described in the Recreation section of this Chapter.

MINERALS AND ENERGY

There was widespread prospecting for gold in the area during and after settlement of this area. Although there were small deposits of gold found in the southern portions of the Willamette National Forest, there is no record that precious metals have ever been found in the analysis area and there are no valid mining claims in existence.

Kitson Hot Springs, the site of Camp Huntington, shows the area's potential for geothermal energy production. There has been some interest in the past in developing this potential. At this time there are no current active leases for geothermal development rights.

The Hills Creek Reservoir is the only energy production facility in the area aside from incidental production of firewood for home and limited commercial use. The electricity generation facilities associated with the reservoir have the potential to generate 34 megawatts of electrical power. This reservoir is primarily a flood-control structure and power generation occurs at various levels depending upon the amount of water released for the management of future flood-water storage potential.

SOCIAL AND ECONOMIC

HISTORY OF THE LOCAL COMMUNITY

The first permanent settlers came to the site of Oakridge around 1860. The Cascade Forest Reserve was formed about 30 years later and this was incorporated into the newly formed Forest Service in 1905. The role of the Forest Service was primarily custodial until the mid-1920's. Prior to that time, timber harvesting was done mostly on a subsistence basis. The land around the newly cleared agricultural areas of Oakridge was used primarily for grazing sheep and cattle, and for hunting and trapping.

Large-scale, commercial timber harvest began in 1925 with the sale of the largest Federal timber harvest contract in the Douglas-fir region to that date. This sale was made to the Western Lumber Company, which is no longer in existence. The town of Westfir was established around the Western Lumber Company mill. From this time on the harvest of timber continually increased until the 1960's when it stabilized at the levels that have been harvested in recent years. Since that original sale, the Oakridge area has been one of the largest timber-producing areas in the country.

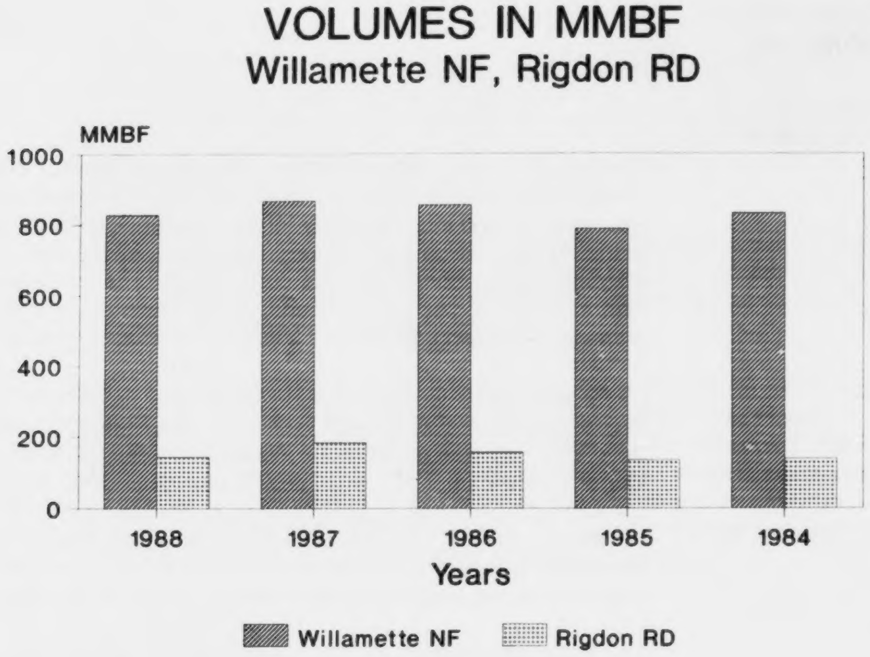
The Willamette National Forest sold about 827 MMBF (gross volume) of timber in 1988, and the Rigdon Ranger District's share of this amount was 144 million or 17 percent of the total volume offered. Figures III-16-A and III-16-B list the volumes of timber sold on the Willamette National Forest and the Rigdon Ranger District in the last 5 years.

SOLD VOLUMES FROM WILLAMETTE NATIONAL FOREST
AND RIGDON RANGER DISTRICT
Fiscal Years 1988-1984 (volumes in MMBF)

Year	Willamette NF Total	Rigdon Ranger District Total	Rigdon MMBF as a % of total WNF
1988	827	144	17
1987	868	184	21
1986	854	156	18
1985	787	136	17
1984	831	139	17

Source: Willamette National Forest totals from the Timber Sales Accounting (TSA) cut and sold reports, gross convertible products. Rigdon Ranger District totals from the Rigdon Ranger District, Timber Management.

Figure III-16-A Sold volumes from Willamette National Forest and Rigdon Ranger District



Fiscal Years 1988-1984

Figure III-16-B Volumes in MMBF Wilamette National Forest and Rigdon Ranger District

Timber harvest increased in this area as forests closer to metropolitan areas in the Willamette Valley and along the coast were cutover. At the same time, recreation in the Oakridge area increased due to decreased recreation opportunities in the valley from increasing populations and development. The completion of the Southern Pacific Railroad over the Willamette Pass facilitated recreational use as well as transportation of the newly developed timber supply.

The Local Community

Oakridge was first established in 1912, although Westfir was initially the most vigorous of the two towns. Westfir was the location of the first lumber mill built for the timber sale contract of 1925. This mill eventually declined and closed in the early 1980's. Pope & Talbot, Inc.'s multi-product mill in Oakridge was built in the 1950's. This mill currently processes about 60 million board feet of timber per year. The mill has closed temporarily several times in the last 10 years due to fluctuations in the lumber market.

The cities of Oakridge and Westfir together have a population of 3,800 people within the city limits. Over 1,000 people live in the rural areas around these cities. Oakridge is the largest city within the Willamette National Forest. Private land for development and expansion is limited. Despite the area's long history of recreational use, timber harvest and processing have dominated the area's economy since the first mill was built in Westfir.

A large portion of government employment in the Oakridge area involves the Forest Service; there are two large Ranger Districts headquartered in this community. Lane and Douglas counties are the main processing areas for timber harvested in the Oakridge area.

The majority of the Lane and Douglas counties labor force are employed in four industries: 1) lumber and wood products, 2) Federal, state, and local government, 3) retail trade, and 4) services. Figure III-17 lists the unemployment rates, numbers of jobs, and average annual wages for these four industries and county totals for the period of 1984-1988.

ECONOMIC STATISTICS FOR LANE AND DOUGLAS COUNTIES 1/
1984 - 1988 (wages in 1988 dollars)

Economic Statistics	1988 2/	1987	1986	1985	1984
LANE COUNTY					
....UNEMPLOYMENT %	5.7	5.7	8.6	8.9	9.2
....EMPLOYMENT (job numbers)					
........Total County jobs	107,500	104,300	99,200	96,900	96,300
........Lumber and Wood Products	11,000	10,800	10,100	10,800	11,700
........Retail Trade	21,400	21,200	20,400	19,900	19,700
........Services & Misc.	25,100	23,800	22,100	20,500	19,700
........Government	22,800	22,200	21,800	21,200	20,900
....WAGE INCOME (in 1988$)					
........Average Total Co. wages	n/a	18,353	18,390	18,505	18,598
........Lumber and Wood Products	n/a	24,756	25,873	26,150	25,903
........Retail Trade	n/a	11,026	11,225	11,282	11,552
........Services & Misc.	n/a	15,696	15,399	15,814	15,758
........Government	n/a	21,877	22,266	21,515	21,555
DOUGLAS COUNTY					
....UNEMPLOYMENT %	8.0	7.6	9.9	11.6	11.6
....EMPLOYMENT (job numbers)					
........Total County jobs	31,730	31,590	30,760	29,640	29,800
........Lumber and Wood Products	8,290	8,700	8,520	7,640	7,920
........Retail Trade	5,620	5,410	5,230	5,230	5,410
........Services & Misc.	5,480	5,430	5,170	4,920	4,720
........Government	6,570	6,450	6,390	6,300	6,380
....WAGE INCOME (in 1988$)					
........Average Total Co. wages	n/a	19,259	19,427	19,700	19,989
........Lumber and Wood Products	n/a	25,966	26,466	27,763	28,439
........Retail Trade	n/a	9,828	10,047	10,058	10,094
........Services & Misc.	n/a	15,385	15,231	14,851	14,579
........Government	n/a	20,973	20,742	20,612	20,478

1/ The four industries listed are Lumber and Wood products, Federal, State and local government, Retail trade, and Services. They are the top four employers in these counties.
2/ Average estimates for 1988 based on the months of January-October.
Source of statistics: State of Oregon, Employment Division, Department of Human Resources, November, 1988.

Figure III-17 Economic statistics for Lane and Douglas Counties

State Highway 58, which passes through Oakridge, is a major travel way across the Cascade Mountains. Many service-sector jobs shown in Figure III-17 are related to the recreational traffic associated with travel to the eastern side of the Cascades, Willamette Pass Ski Area, Waldo Wilderness Area, and Waldo Lake Recreation Area. Much of this traffic is believed to come from the Eugene/Springfield area.

CONTRIBUTIONS TO EMPLOYMENT

The area of influence for this project is defined by the flow of commodities from the Rigdon Ranger District (RD) and by place-of-residence of Rigdon RD area users. The majority of log volume is processed in Lane County with a smaller percent processed in Douglas County. The total volume and WNF-specific volume of logs processed in Lane and Douglas counties in 1982 and 1985 are listed in Figure III-18.

LOGS PROCESSED IN LANE AND DOUGLAS COUNTIES
1985 and 1982 (Thousands of board feet, Scribner Log Rule)

LANE COUNTY

Year	Total Logs Processed	National Forests Source	Willamette NF Source	Total WNF Log Flows	WNF Source as a % of WNF Logs	WNF Source as a % of Total Logs
1985	1,288,400	521,187	420,974	671,456	63	33
1982	1,132,880	398,550	284,651	430,318	66	25

DOUGLAS COUNTY

Year	Total Logs Processed	National Forests Source	Willamette NF Source	Total WNF Log Flows	WNF Source as a % of WNF Logs	WNF Source as a % of Total Logs
1985	1,077,322	382,231	39,206	671,456	6	.04
1982	721,108	180,245	3,809	430,318	.01	.01

Source: Oregon's Forest Products Industry, 1985 and 1982, USDA Resource Bulletins PNW RB-149 and PNW 118, respectively. Forest Sciences Laboratory, Portland, OR.

Figure III-18 Logs Processed in Lane and Douglas Counties

Most recreational and hunting day-use on the district is from local Oakridge/Westfir residents and Eugene/Springfield metro-area residents. The total population for the past decade for Lane and Douglas counties and for specific communities in the area of influence are shown in Figures III-19-A and III-19-B.

POPULATION ESTIMATES FOR LANE AND DOUGLAS COUNTIES AND SELECTED COMMUNITIES

County and City	1988*	1987	1986	1985	1984	1983	1982	1981	1980	1979	1978
Lane County	273,700	267,700	261,650	269,500	268,500	267,900	270,650	275,000	275,200	269,550	262,700
...Eugene/Sprfld	n/a	148,085	147,030	146,790	145,365	143,025	144,850	147,640	147,350	144,925	138,225
...Oakridge/Westfir	n/a	3,800	3,745	3,880	3,795	3,765	3,860	3,985	3,990	4,010	3,960
Douglas County	93,000	93,000	92,700	92,150	91,000	90,400	92,050	92,300	93,400	92,400	90,250
...Roseburg	n/a	15,930	15,890	16,025	15,800	15,620	15,880	16,200	16,530	16,350	16,175

* Estimated change in population as of July, 1988.

Source: State of Oregon, Employment Division, Department of Human Resources, November, 1988.

Figure III-19-A Population estimates Lane and Douglas Counties

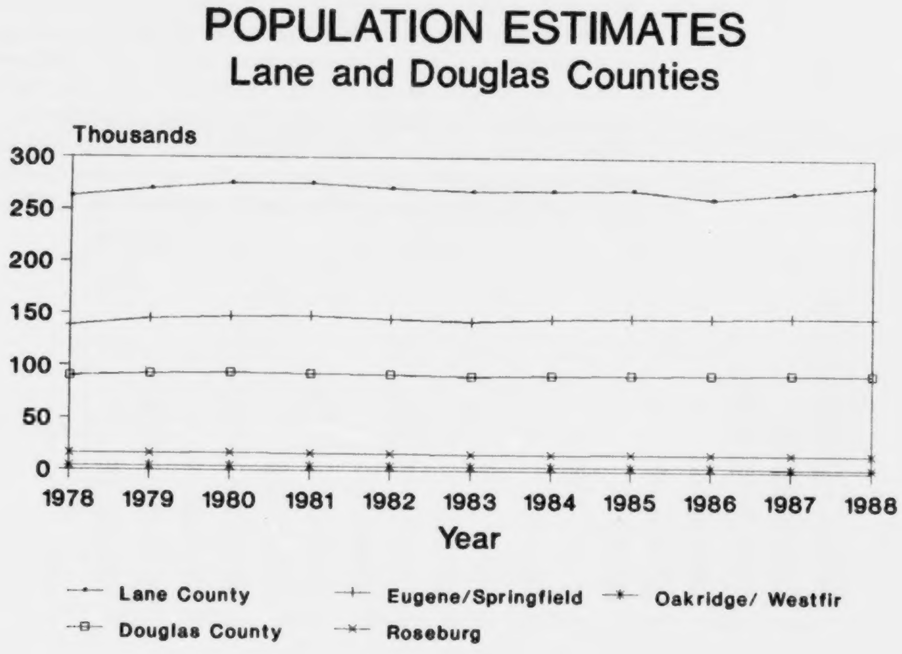


Figure III-19-B Population estimates Lane and Douglas Counties

CONTRIBUTIONS TO COUNTY FUNDING

Twenty-five percent of gross receipts from the sale of resource commodities from National Forests lands are returned to county governments on a fiscal year basis. These payments were established by the Twenty-five Percent Fund Act (U.S. Congress 1908) and have come to be considered compensation for property taxes that would accrue to the county if these lands were under private ownership. The gross receipts include monies collected under the Knutson-Vandenberg (K-V) Act (U.S. Congress 1930) and road purchaser credits. In the State of Oregon, 75 percent of the receipt-sharing payment must be used to supplement the county road budget, and the remaining 25 percent goes to public schools. These funds are distributed to counties based upon the percentage of Willamette National Forest acreage that occurs in each county. On lands recovered from the Oregon and California (O&C) Railroad land grant, the counties receive 50 percent of the net timber receipts. There are no O&C lands in the analysis area.

The State of Oregon and Lane County consistently receive the largest payments made to any state or county, respectively, in the United States. On the Willamette National Forest the timber sales program produces 99 percent of the Forest's receipts to the treasury, including K-V funds, and road purchaser credits. In 1987, timber harvest on the Willamette National Forest contributed about $81 million to the Federal treasury and 17 percent of that came from timber harvested on the Rigdon Ranger District. Payments to Lane and Douglas counties from the Willamette National Forest for fiscal year's 1980-1988 are listed in Figures III-20-A and III-20-B. There are four additional counties that share in Willamette National Forest's receipts on a per acre basis. Clackamas, Jefferson, Linn, and Marion county payments will also be affected by log and other commodities flows from lands administered by the Rigdon Ranger District. Harvest in 1987 from the Rigdon Ranger District contributed about $4.6 million to these payments.

PAYMENTS TO SELECTED COUNTIES FROM WILLAMETTE NATIONAL FOREST RECEIPTS
Fiscal Years 1988-1980 (in 1988 Dollars)

Year	Lane County	Douglas County	Willamette NF Totals	Oregon State Totals (all NF's)
1988	16,143,378	836,545	27,000,000	116,983,074
1987	18,317,477	949,201	30,623,248	135,900,109
1986	16,120,880	835,380	26,962,371	124,157,690
1985	14,150,434	733,394	23,668,379	102,854,679
1984	10,961,453	568,099	18,334,216	97,121,151
1983	11,134,496	577,091	18,621,492	80,591,898
1982	9,834,327	509,790	16,451,415	56,659,533
1981	16,808,767	870,846	28,103,193	122,327,694
1980	21,598,345	1,119,443	36,120,728	139,630,371

Figure III-20-A Payments to selected counties

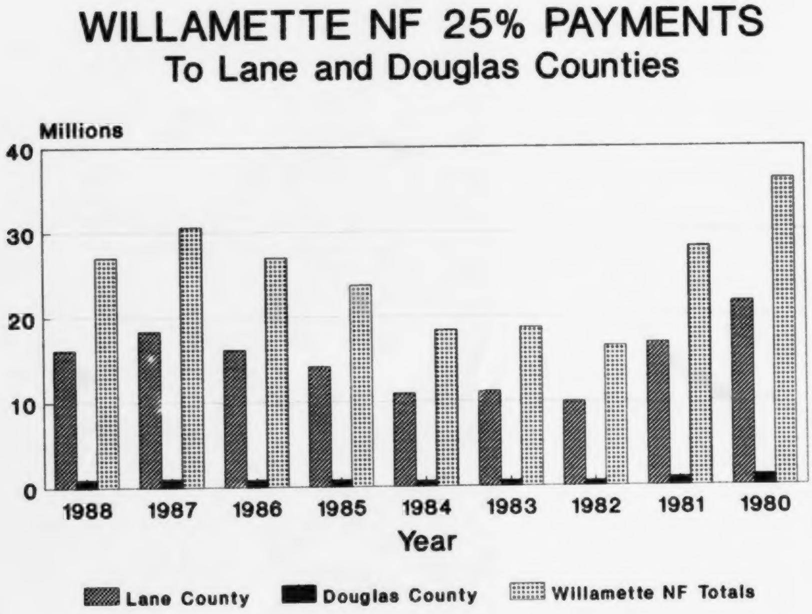


Figure III-20-B Willamette National Forest 25 Percent Payments

SHADY BEACH RECOVERY PROJECT COSTS:

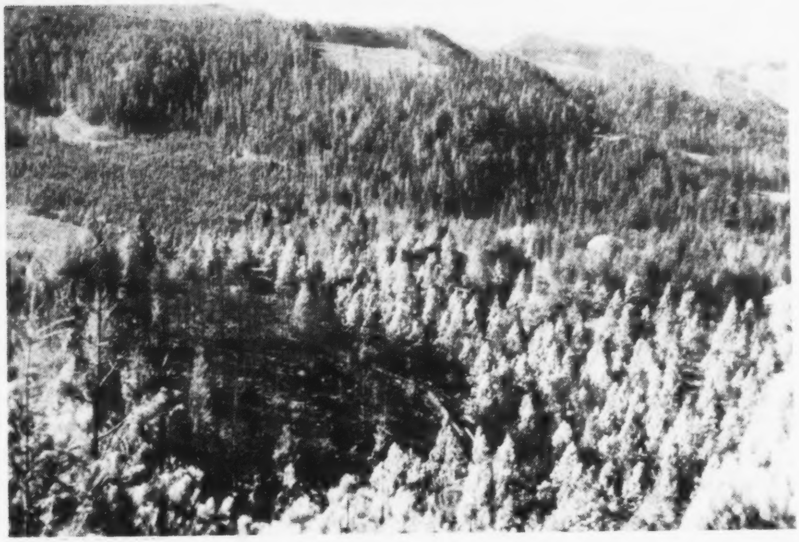
The alternatives discussed in the preceding chapter have some fixed and variable costs that are associated with particular alternatives. In addition to the alternative-specific revenues and costs, there are monies that have already been spent in the project area. These costs are listed below.

1. The cost of fire suppression and containment is estimated at $14 million.

2. The emergency rehabilitation costs amount to $105,000. The rehabilitation/mitigation activities include streambank seeding and fertilization, snag removal along roads, sediment traps over road culverts, and a log boom to catch large debris in Hills Creek Reservoir.

3. The cost of preparing and implementing the Environment Impact Statement documents is estimated at $1.6 million as of November, 1988.

ENVIRONMENTAL CONSEQUENCES



INTRODUCTION

This chapter discusses the environmental effects that would occur if each of the five alternatives presented in Chapter II were implemented. The effects of all alternatives are listed by the resources presented in Chapter III and are presented in absolute terms; the effects are not compared between alternatives. This discussion also forms the scientific and analytical basis for the alternative comparisons presented in Chapter II. The effects of Alternative E - No Action illustrate the post-fire conditions in the analysis area and form a baseline against which all other alternatives are evaluated.

Environmental effects can be direct, indirect, cumulative, and of long- or short-term duration. These effects, whether adverse, beneficial, actual, or potential, may be significant or not significant. Most of the estimated effects are described briefly, and the more important ones are discussed in detail. Potential significant effects are identified; other effects are not considered significant. There is a summary at the end of this Chapter on expected unavoidable, irreversible, and irretrievable effects and for those effects anticipated to conflict with other agencies' policies and directions.

Cumulative effects are also addressed in this analysis. Cumulative effects are produced by a combination of events occurring over space and/or time. Wildfire and resultant recovery activities are a good example of this concept. Establishment of the Shady Beach analysis area to include all subwatersheds affected by the fire rather than just the areas burned was done to facilitate the analysis of cumulative effects on wildlife, water quality, and scenic quality.

In order to address cumulative effects on the Hills Creek Reservoir, the entire watershed of the Middle Fork of the Willamette River above the Hills Creek Dam was considered as the extend of the analysis area. For other water quality issues, the entire watershed of the Class I portions of Hills Creek was considered, in addition to the entire watersheds of any critical stream reaches. One subwatershed, in addition to the analysis area, was analyzed for cumulative effects to wildlife habitat.

Activities occurring within these watersheds, but outside of the Shady Beach analysis area, have been taken into account in estimating cumulative effects. All past management activities and other events, such as the Shady Beach fire, have been included in this cumulative effects analysis. Present and planned timber sales in the analysis area have been included in this analysis. For cumulative effects analysis, it is assumed that these projects will be implemented if they are located outside of the fire area.

For the purpose of this analysis, the assessment of effects assumes compliance with Federal laws, National policies, Regional standards and guidelines, and the Final EIS and Willamette National Forest Multiple-Use Land Management Plan and Timber Management Plan (1977). When the Proposed Forest Plan/DEIS is approved, the standards and guidelines from that document will be applied to the management of the analysis area.

Many of the effects discussed in this Chapter are complex and not easily quantified. In this light, it should be kept in mind that many of the values presented are modeled predictions of the effects and the actual effects may not occur exactly to the degree presented.

GEOLOGY AND SOILS

INTRODUCTION

The effects of the Shady Beach fire and potential recovery activities can produce short- and long-term consequences affecting soil and site productivity. These effects include acceleration of mass wasting, site productivity declines from reductions in surface erosion. The magnitude and duration of these effects depend on climatic events, post-fire hydrologic conditions, wildfire burn intensities, and the extent of soil disturbance resulting from the implementation of the array of alternative management activities.

Wildfire and forest management practices can degrade soil productivity in a variety of ways and may include:

Reduction of organic materials, humus, mineral nutrients, and soil from erosion, combustion, and volatilization processes.

Erosion due to an increase in surface-water flow by removal or loss of duff, litter, and large woody material.

Erosion due to collection and concentration of run-off water by roads, landings, and yarding corridors.

Erosion due to the loss or removal of soil-anchoring vegetation.

Changes in plant succession patterns and, ultimately, competition affecting regrowth of young conifer seedlings.

Acceleration of mass soil movement due to an increase in soil-water storage and subsurface water flow from the loss of transpiring vegetation.

Increases in stream sediment transport resulting from loss of vegetative cover and increases in surface-soil erosion and mass wasting.

Soil Productivity

Soil productivity effects are analyzed only for the area affected by the fire. Soil Productivity declines are estimated by declines in organic material on a site. The largest effect of a wildfire on site productivity is the consumption of total organic material (TOM) which is one of the main reserves of readily available nutrients on forest sites. TOM is a way of evaluating relative effects on productivity and is not intended to imply an absolute reduction in long-term site productivity.

Amounts of TOM remaining under each alternative were estimated, using: 1) amounts of material existing before the fire as a function of slope and aspect, 2) estimates of burn severity in relation to the amount of vegetation and forest-floor, organic material consumed, 3) the amounts of organic material removed through harvest and associated site preparation and fuels treatment prescriptions, and 4) the amount of material retained along riparian areas and on sites as wildlife trees. Harvest removes the large woody material in the form of merchantable and unmerchantable logs. It also causes accelerated root decay and removes or rearranges surface litter and duff through fuels treatment or logging disturbance.

There is a lack of information about the effects of removing a portion of the organic material on a site. This makes an evaluation of specific soil-productivity effects of each alternative difficult. Any amount of organic material on a site would contribute to the nutrient status and soil condition, but there re uncertainties as to the minimum amount required to maintain long-term productivity.

More information on TOM effects on site productivity can be found in Appendix A of this document, Soils: Total Organic Material (TOM) report. There is also more information on site-productivity effects in the Final Environmental Impact Statement, Appendix C, Site-Productivity Report, Silver Fire Recovery Project, Siskiyou National Forest (USDA Forest Service 1988a).

Surface-Soil Erosion

Surface-soil erosion naturally occurs on the steep, dissected slopes of the analysis area. The amount and extent of the natural, surface-soil erosion depends on the amount of protective vegetation and organic material and the ability of the root mass to hold the soil. The combined impacts of the wildfire and management activities would increase surface-soil erosion above the natural rates.

Areas that experienced high fire intensities and which have a high potential for surface-soil erosion are expected to contribute the most to surface-soil erosion. This condition, which occurs on about 20 percent of the fire area, was identified during field survey by soil scientists working on this recovery project. It occurred primarily in clearcuts on steep ground which had little or no fuels reduction prior to reforestation. These areas are localized and generally occurred on steep slopes with a heavy pre-fire fuel loading where the fire was intense enough to consume all organic material.

Timber harvest activities and road construction on steep-sloped, bare soil areas will increase the potential for surface erosion. The effects will vary greatly between sites depending on remaining protective ground cover, degree of slope, closeness to a drainage or stream, and logging method.

Surface-soil erosion percent increases were estimated using the number of acres affected by varying intensities of fire. This relates soil effects to removal of vegetation and organic material and to the amount of disturbance expected from harvest activities and road construction. The coefficients developed in Swanson's and Grant's (1982) inventory, then were applied to criteria to give an estimate of the relative amount of erosion increases (process paper on combined erosion rates may be found in the Shady Beach Fire Recovery Project Analysis File). These coefficients express an erosion level that includes both surface-soil erosion and mass-soil movement.

Mass Wasting

The most likely mass-wasting events that would occur in the analysis area as the result of fire or harvesting effects are shallow debris sides. Road construction in sensitive, steep terrain and across steep drainages increases the potential for debris torrents and other slope failures. Excavation for roads and landings removes support from slopes above the road and can change surface and subsurface drainage.

Increases in mass wasting are combined with surface soil-erosion increases because the same factors that affect surface-soil erosion increases also affect the frequency of mass-wasting events.

EFFECTS COMMON TO ALL ALTERNATIVES

Some forest canopies were eliminated by the fire. This has resulted in a decrease in interception of precipitation and evapo-transpiration. This increases the potential for surface-soil and mass-wasting erosion. In most of the burn area, the forest floor (litter and duff) were consumed. Exposed mineral soil is vulnerable to rainfall impact or snow melt run-off since the infiltration rates may be reduced and duff layers are absent. Increased surface water yield can affect stream channel stability and may result in increased sediment production. In areas where the transpiring vegetation is lost, groundwater recharge will occur with a negative effect on soil-mantle stability.

In the worse case, mass wasting could take place primarily in or adjacent to stream courses in the form of debris/avalanche flows. Movement would begin in the upper, steep, headwall reaches of the drainages, in areas with shallow soils, and would progress down stream removing all or most of the soil material, exposing the underlying bed rock. Total natural recovery of the drainages could take many years as soil erosion and rock weathering processes replace the lost soil materials. In the steeper drainages and reaches, total recovery may never take place.

Large potentially unstable areas within the project boundary, slumps and earthflows, could be activated but, due to the nature of the soils in the area, large-scale catastrophic mass wasting has an extremely low probability of occurring. These large scale movements would be relatively slow and could continue to supply sediment to the streams until natural recovery was sufficient to allow for establishment of equilibrium in the soil mass.

EFFECTS COMMON TO ALTERNATIVES B, C, D, AND F

In order of significance, risk of surface-soil erosion would come from: 1) road construction on highly erosive soils; 2) increased number of stream crossing by roads; and 3) harvest units on highly erosive soils which have been affected by high fire intensity. The increased risk of surface-soil erosion would last 10 years, diminishing to a minimum in 20 years. The rate of vegetation re-establishment determines the duration of harvest units surface-soil erosion. Normally, the harvested areas with low-to-moderate, fire intensity are expected to recover in 3 to 7 years, and high fire intensity areas would recover within 10 years.

In areas with a moderate-to-high risk of mass wasting, there would be increased risk of headwall and streambank failures, debris torrents, and associated channel scour. It is not possible to predict the timing and magnitude of episodes of mass wasting. The mass wasting would decrease soil productivity and increase sediment delivery to streams. Productivity losses are irretrievable and soil fertility is renewable only over long periods of time. The risk of mass wasting from harvest activities and road construction continues into the second decade.

ALTERNATIVE E NO ACTION

In this alternative, initial recovery of vegetation and TOM will rely on regrowth of grasses, forbs, shrubs, and conifer seedlings. The rapidity of this vegetation recovery will depend on the degree of fire intensity, soil mantle stability, resprouting of vegetation, availability of seed sources, and environmental factors affecting plant growth. Complete natural revegetation would take approximately 3 to 7 years on areas of low-to-moderate, fire intensity (see Glossary) and approximately 10 years on areas with a high fire intensity.

Total Organic Material (TOM)

Total organic material contributions to soil productivity would be reduced until the forest returns to the vegetative diversity and maturity of pre-fire conditions. Figure IV-1 describes the distribution of TOM both pre-fire and post-fire. Losses of organic material by fire intensity are shown in Figure IV-2. An indirect but significant beneficial effect of this alternative would be the supply of large woody material to the site, over time, as dead trees fall to the forest floor. New organic material contributions to soil productivity in the first decade would increase as branches and organic material would increase over the next 10 years and would become greater than pre-fire conditions, while above-ground organic material would decrease from pre-fire conditions. In 20 years, ground-level organic material would still be greater than pre-fire amounts and above-ground, standing material would decline significantly. After 30 years, total organic material would be approaching pre-fire conditions with a greater amount of material on the forest floor, but an increasing amount in the above-ground component as trees recapture the sites.

Surface-Soil Erosion

There would be a 63 percent increase in eroded material from pre-fire conditions to post-fire conditions (see Figure IV-3). The increase in surface-soil erosion would occur on steep-sloped areas where vegetation, litter, and duff have been destroyed and soils exposed. Soils with a high potential for surface-soil erosion, that experienced high fire intensities, would produce the greatest contribution to surface-soil erosion. These areas comprise approximately 20 percent of the fire area. Erosion on the

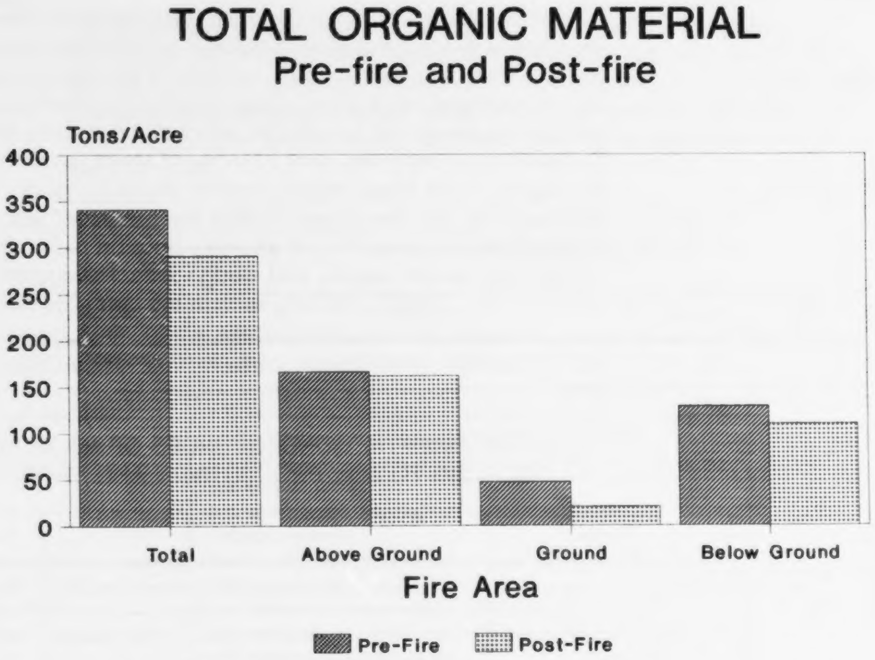


Figure IV-1 Distribution of TOM pre- and post-fire

LOSSES OF ORGANIC MATERIAL BY FIRE INTENSITY
POST-FIRE ESTIMATES OF TOTAL ORGANIC MATERIAL

Fire Intensity	Acres(%)*	Above-Ground (%)	Ground Level (%)	Below-Ground (%)	Total (%)
Moderate	4164 (55%)	-4%	-64%	-22%	-20%
Moderately-Low	2430 (32%)	-2%	-59%	-9%	-12%
Low	317 (4%)	-0%	-61%	-5%	-9%
Unburned	662 (8%)	-0%	-0%	-0%	-0%

*Acreage excludes private lands, unsuited lands, rock outcrop, and plantations

Figure IV-2 Post-fire estimates of TOM

steep slopes would consist of primarily dry ravel and minor amounts of rill erosion. Most areas of low and moderate fire intensity would contribute less eroded material due in part to the protective conifer needle cover which fell to the soil surface almost immediately following the fire. Low fire-intensity areas still have a protective duff layer over the soil. Within 3 to 10 years after the fire, soil erosion would be reduced as protective organic materials (live vegetation, needle and leaf fall, branches, and large woody debris) accumulate on the site.

Mass Wasting

Landslides are estimated to generate the greatest portion of the 63 percent increase in eroded materials predicted for post-fire conditions. Minimal management activities such as removal of dangerous trees along roads would not significantly affect slope stability. Replanting of fire-damaged plantations would not beneficially affect slope stability for several years. Depending on the timing and intensity of storm events and the rate of root decay, most mass-wasting events would occur during major storm events within the first 10 years after the fire. Most failures would be concentrated in areas of high-intensity burn on older slide landforms, along steep stream banks, and along roads. Revegetation by artificial and natural means would gradually reduce the landslide rate to the pre-fire level. However, the recovery process would take longer than if reforestation and streamside rehabilitation were done promptly over the whole fire area.

ENVIRONMENTAL CONSEQUENCES OF NO ACTION
RELATING TO SOIL PRODUCTIVITY AND EROSION

Factor	Indicator	Measure	Rating
Total Organic Material	* % remaining (tons/acre) from pre-fire to post-fire	85% (341)	NA
Surface-soil Erosion and Mass Wasting	* % increase (cu yds/acre/yr) of eroded material from pre-fire to post-fire	63% (1.14)	NA

Ratings are relative risk of loss of soil productivity, not actual magnitude of change. H - High, M - Moderate, L - Low, N - Negligible. A low level of organic material left on site creates a high risk of productivity loss.
NA = Not applicable

Figure IV-3 Environmental consequences of no action

ALTERNATIVE B

Total Organic Material (TOM)

The total organic material (TOM) remaining with this alternative would be approximately 71 percent of post-fire levels. This reduction would occur as a result of the proposed timber harvest and subsequent fuels treatment. Streamside management units, some wildlife trees, and post-logging slash on areas not treated for fuels reduction would be left, which would result in some future recovery of TOM. It is estimated that, in 10 years following harvest, all managed areas would have vegetation re-established. After 10 years, the ground-level organic material would be greater than the pre-fire conditions, the above-ground level would be less than the pre-fire, and the below-ground organic material would be close to duplicating the pre-fire conditions. It is expected that 20 or more years would be required to return to pre-fire conditions. This process would take somewhat longer on the 195 acres of unsuited timber land that would likely not be completely reforested.

Surface-soil Erosion

This alternative would have a relatively high potential of increasing the risk surface-soil erosion. See Figure IV-4 for a listing of consequences and risk ratings for surface-soil erosion. There would be a 5 percent increase in eroded material over post-fire rates. These estimates for surface-soil erosion quantities are combined with estimates of eroded material from mass wasting.

ENVIRONMENTAL CONSEQUENCES OF ALTERNATIVE B
RELATING TO SOIL PRODUCTIVITY AND EROSION

Factor	Indicator	Measure	Rating
Total Organic Material	* % remaining (tons/acre) from post-fire	71% (206)	M
Surface-soil Erosion	* % increase (cu yd/ac/yr) of erosional material (surface erosion and mass wasting) from post-fire	5% (1.20)	H
	* acres of harvest units in high and very high soil erosion rating.	2090 ac.	H
	* % of high and very high soil erosion rating in high fire intensity.	51%	H
	* miles of road in high and very high soil erosion rating.	3.45 mi.	H
Mass Wasting	* % increase in harvested acres of incidental green timber with high and moderate relative risk of mass wasting.	8%	H
	* % increase in miles of road in areas with high and moderate relative risk of mass wasting in areas of high Tree mortality except temporary roads in units.	38%	H
	* % increase in number of Class III and IV streams crossed by roads.	170%	H

Ratings are relative risk of loss of soil productivity, not actual magnitude of change. H - High, M - Moderate, L - Low, N - Negligible. A low level of organic material left on site creates a high risk of productivity loss.

Figure IV-4 Environmental consequences of Alternative B

Mass Wasting

There would be a relatively high potential for increasing the risk of mass wasting over the post-fire level. The risk would be from: 1) an 8 percent (170 acres) increase in harvest of incidental green timber in moderate-to-high risk areas for mass wasting; 2) road construction in moderate-to-high risk areas for mass wasting and with high tree mortality; and 3) increased number of Class III and IV stream crossings by roads.

ALTERNATIVE C

Total Organic Material (TOM)

Total organic material remaining would be an approximate 74 percent of post-fire conditions. The reduction would occur as a result of the proposed timber harvest and fuels treatment of slash. Streamside management units, some wildlife trees, and post-logging slash on areas not treated for fuels reduction would remain. All areas clearcut or shelterwood cut will be reforested. Unsuited lands harvested (171 acres) will be planted but are not expected to be fully re-established with trees.

Surface-Soil Erosion

There would be a relatively high potential for increasing the risk of surface-soil erosion with this alternative. There would be a 4 percent increase in eroded material including that from mass wasting from post-fire rates. See Figure IV-5 for a listing of key indicators, a list of other indicator characteristics referring to potential high-concern areas, and risk ratings for surface-soil erosion and mass wasting.

ENVIRONMENTAL CONSEQUENCES OF ALTERNATIVE C
RELATING TO SOIL PRODUCTIVITY AND EROSION

Factor	Indicator	Measure	Rating
Total Organic Material	* % remaining (tons/acre) from post-fire	74% (216)	M
Surface-soil Erosion	* % increase (cu yds/ac/yr) of erosional material (surface erosion and mass wasting) from post-fire	4% (1.19)	H
	* acres of harvest units in high and very high soil erosion rating.	2,061 ac	H
	* % of high and very high soil erosion rating in high fire intensity.	49%	H
	* miles of road in high and very high soil erosion rating.	2.30 mi.	M
Mass Wasting	* % increase in harvested acres of incidental green timber with high and moderate relative risk of mass wasting.	5%	M
	* % increase in miles of road in areas with high and moderate relative risk of mass wasting in areas of high tree mortality except temporary roads in units.	26%	H
	* % increase in number of Class III and IV streams crossed by roads.	125%	H

Ratings are relative risk of loss of soil productivity, not actual magnitude of change. H - High, M - Moderate, L - Low, N - Negligible. A low level of organic material left on site creates a high risk of productivity loss.

Figure IV-5 Environmental consequences of Alternative C

Mass Wasting

This alternative would have a relatively moderate potential for increasing risk of mass wasting over the post-fire level. The risk would be from the 5 percent (107 acres) increase in harvest of incidental green timber in areas of moderate-to-high risk for mass wasting. The miles of road construction in areas with a moderate-to-high risk for mass wasting and with high tree mortality would also contribute to the increased risk.

ALTERNATIVE D

Total Organic Material (TOM)

Total organic material remaining would be an approximate 76 percent of that remaining after the fire. The reduction would occur as a result of the proposed timber harvest and fuels treatment of slash. Due to the large amount of aerial logging, there will be a minimum amount of ground disturbance from logging. This alternative would retain much of the remaining surface organic material and surface-soil organic matter, which functions as the zone of maximum nutrient cycling. Streamside management units (SMUs), some wildlife trees, and post-logging slash would be left. It is estimated that, in 10 years following harvest, all managed areas will have vegetation re-established. This may take somewhat longer on the 156 acres of unsuitable timber land that would be harvested but not completely re-established.

Surface-Soil Erosion

There would be a relatively low potential for increasing the risk of surface-soil erosion with this alternative. Erosion material including that from surface-soil erosion and mass wasting is predicted to be increased by 1 percent from post-fire rates. See Figure IV-6 for a listing of key indicators, a list of other indicator characteristics referring to potential high-concern areas, and risk ratings for surface-soil erosion and mass wasting. No new system roads would be built, but there would be some landing development for aerial logging. Surface-soil erosion will come from harvest units located on highly erosive soils which have been affected by a high fire intensity. Aerial logging would reduce the amount of erosion; but, due to the extensive area proposed to be harvested, the projected erosion rates would increase somewhat. The risk of surface-soil erosion would last approximately 10 years. Vegetation re-establishment determines the duration of harvest-unit surface-soil erosion. Normally, the harvest clearcuts with low-to-moderate fire intensity are expected to recover in 3 to 7 years, and high fire intensity areas would recover within 10 years.

Mass Wasting

In this alternative, there would be relatively low potential for increasing the risk of mass wasting form post-fire levels. The minor risk would be from areas which harvest incidental green timber along the logging corridors and other minor high-risk areas where predicted mortality is greater than 40 percent.

ENVIRONMENTAL CONSEQUENCES OF ALTERNATIVE D RELATING TO SOIL PRODUCTIVITY AND EROSION

Factor	Indicator	Measure	Rating
Total Organic Material	* % remaining (tons/acre) from post-fire	76%(222)	M
Surface-soil Erosion	* % increase (cu yds/ac/yr) of erosional material (surface erosion and mass wasting) from post-fire	1%(1.15)	H
	* acres of harvest units in high and very high soil erosion rating.	2,140 ac	H
	* % of high and very high soil erosion rating in high fire intensity.	51%	H
	* miles of road in high and very high soil erosion rating.	0 mi.	N
Mass Wasting	* % increase in harvested acres of incidental green timber with high and moderate relative risk of mass wasting, except logging corridors.	0%	N
	* % increase in miles of road in areas with high and moderate relative risk of mass wasting in areas of high tree mortality except temporary spurs in units.	0%	N
	* % increase in number of Class III and IV streams crossed by roads.	0%	N

Ratings are relative risk of loss of soil productivity, not actual magnitude of change. H - High, M - Moderate, L - Low, N - Negligible. A low level of organic material left on site creates a high risk of productivity loss.

Figure IV-6 Environmental consequences of Alternative D

ALTERNATIVE F

Total Organic Material (TOM)

Total organic material remaining would be an approximate 84 percent of that remaining after the fire. The reduction would occur as a result of the proposed timber harvest and fuels treatment of slash. Streamside management units, some wildlife, trees, and post-logging slash on areas not treated for fuels accumulation would be left. This alternative would retain 3,066 acres of unharvested fire-damaged stands which will not be treated for fuels reduction. It is estimated that by 10 years following harvest all managed areas will have vegetation re-established. This revegetation would take somewhat longer on the 137 acres of unsuitable timber lands harvested but not fully re-established.

Surface-Soil Erosion

There would be a relatively moderate potential for increasing the risk for surface-soil erosion with this alternative. There would be a 3 percent increase in eroded material including that from mass wasting from post-fire rates. See Figure IV-7 for a listing of key indicators, a list of other indicator characteristics referring to potential high-concern areas, and risk ratings for surface-soil erosion and mass wasting.

ENVIRONMENTAL CONSEQUENCES OF ALTERNATIVE F RELATING TO SOIL PRODUCTIVITY AND EROSION

Factor	Indicator	Measure	Rating
Total Organic Material	* % remaining (tons/acre) from post-fire	84% (245)	L
Surface-soil Erosion	* % increase (cu yd/ac/yr) of erosional material (surface erosion and mass wasting) from post-fire	3% (1.17)	H
	* acres of harvest units in high and very high soil erosion rating.	1,204 ac	L
	* % of high and very high soil erosion rating in high fire intensity.	38%	M
	* miles of road in high and very high soil erosion rating.	1.0 mi.	L
Mass Wasting	* % increase in harvested acres of incidental green timber with high and moderate relative risk of mass wasting.	4%	L
	* % increase in miles of road in areas with high and moderate relative risk of mass wasting in areas of high Tree mortality except temporary roads in units.	22%	M
	* % increase in number of Class III and IV streams crossed by roads.	95%	L

Ratings are relative risk of loss of soil productivity, not actual magnitude of change. H - High, M - Moderate, L - Low, N - Negligible. A low level of organic material left on site creates a high risk of productivity loss.

Figure IV-7 Environmental consequences of Alternative F

Mass Wasting

In this alternative, there would be relatively moderate potential for increasing the risk of mass wasting form post-fire levels. The risk would be from the 4 percent (75 acres) increase in harvest of incidental green timber in areas of moderate-to-high risk for mass wasting. The construction of roads in high-risk areas with high tree mortality would also contribute to the increased risk.

WATER AND FISH

WATER

Water quality and fish habitat in Hills Creek and its major tributaries and reservoir are critical environmental concerns. Anticipated effects on water quality include streamflow increases, increases in sediment yield and turbidity, and increases in summer stream temperature. Fish habitat would be negatively affected by all these increases.

FISH

Fish habitat is a primary beneficial use of the water resources. Fire damage and management activities affect hydrological features which can create significant effects in the quality and effectiveness of fish habitat. Harvest activity or fire, affects streamflow, sediment yields, turbidity, and stream temperature.

A fish survey was conducted during the fall of 1988. In addition to Hills Creek, the only Class I stream in the analysis area, fish were found in several Class II and III streams. Inside the fire area, fish were found in Bull, Landes, Skipper and Unnamed (122RD) creeks. Physical blockage which prevents fish migration occurs 800 feet above the mouth of Landes Creek and at the falls three eights of a mile above the mouth of both Skipper and Unnamed (122RD) creeks. Fish were also found in Big Willow and Warfield Creeks, both located outside the fire area yet inside the analysis area.

Streamflow and Sediment

Change in streamflow directly affects sedimentation and turbidity. Changes in streamflow can also affect the capability of fish to occupy or find passage in stream channels. (This can be positive or negative.) During periods of low flow, increased streamflow could increase the potential of small tributaries to provide passage for fish. During peak-flow periods, increased streamflow could decrease the amount of winter resting habitat in a stream segment and could cause removal of large woody debris from Hills Creek. As discussed in Chapter III, Hills Creek has a limited amount of large woody debris as a result of the 1964 flood. Further removal of the remaining large woody debris in this stream could lead to long-term reductions in fish-habitat capability (Skeesick 1989).

Increases in sedimentation resulting from either increased streamflow or increased erosion may significantly affect fish habitat effectiveness. Sediment loading in tributaries and primary stream courses decreases the amount of resting and holding-pool habitat available to fish. Sediment accumulations can affect the availability of crevices among rocks, roots, and large woody debris. These structural habitat features are required by fish, especially juveniles, for escapement from high-velocity streamflows during winter storm events (Skeesick 1989).

Sediment loading also can have a severe impact on reproductive success, juvenile vigor, and quality of fish produced by spawning. Fine sediment can bury spawning beds, thus inhibiting reproduction. Eggs laid in spawning beds that are filled with sediment may fail to develop or may develop improperly due to lack of oxygen. Young fish hatched in spawning beds which become buried in sediment will suffocate or will be trapped in the gravel and die. Once eggs are fertilized, the embryos develop for 3 months in the spawning bed before they emerge. Turbidity during late spring and summer will be lower than during fall and winter. However, fine suspended sediment can enter streams during spring and summer as well as in the fall and winter. Increased suspended sediment in aquatic systems during spring and summer will result in decreased production of paraphytes (plants and invertebrates which develop on the surface of rocks and other submerged material); these paraphytes are an important component of this fisheries' food base. This increase in the delivery of fine, suspended sediment can result in decreased production and growth of fish (Skeesick 1989). Suspended sediment in fish-bearing streams can also have a short-term effect on the ability of trout, which are sight feeders, to locate prey items. Turbidity in Hills Creek Reservoir has been cited as a primary factor in fisheries decline after the 1964 flood (Phillips 1967).

Temperature

Increasing water temperature may affect fish habitat by decreasing dissolved oxygen levels (Wade 1988). Low dissolved oxygen however, rarely affects salmonids in flowing streams because water is constantly aerated by riffles as long as temperature does not limit the oxygen saturation potential (USDA Forest Service 1985).

As water temperature increases above 58 degrees Fahrenheit (F), fish metabolic rates increase, and less energy supplied by the food base is available for growth and reproduction. This results in a decrease in fish production (Reeves 1985; Skeesick 1989). Salmonids become stressed at temperatures above 70 degrees F (USDA Forest Service 1985).

Stream temperature can also have an effect on fisheries potential through possible relationships between water temperature and vulnerability of fish to diseases (USDA Forest Service 1985). Impacts of diseases on fish may be dependent on temperature. For example, *Ceratomyxa shasta*, a protozoan parasite of rainbow trout, has been studied (Udey and others, 1975) in relation to water temperature. Resistance of fish to this disease was present at low-water temperatures, but resistance to the disease decreased as water temperature increased. Similar temperature relationships may be present in other diseases of cold-water fish.

In addition to the effects that loss of streamside vegetation has on water temperature, there are other potential impacts on fisheries. Insects and litterfall from terrestrial vegetation account for up to 50 percent of the food base entering small and moderate-sized streams. The food material in tributary streams which does not provide fish habitat is concentrated as it flows downstream into fish-bearing streams. Thus, removal of streamside vegetation along all streams, whether permanently flowing or intermittent, can result in decreased fish production. Loss of cover adjacent to streams also affects the ability of fish to find concealment and escapement cover from predators (Skeesick 1989). These effects are short-term, because they will be much reduced when streamside vegetation recovers in about 25 years (Stewart and others, 1989).

Large Woody Debris

The importance of large woody debris (LWD) in stream systems for stabilizing stream channels is discussed in the Water and Fish section of Chapter III under channel morphology and water quality. Large woody debris in stream systems is also vitally important to fisheries, improving aeration of water, which in turn improves dissolved-oxygen concentrations. Large woody debris also provides nutrients to the aquatic and riparian ecosystem food chains. Large woody debris is important in creating structural diversity within the stream system, which is an important feature in aquatic and riparian habitats. Large woody debris in streams creates pools where fish can live and find calm water for resting and cover for hiding. Trout are territorial so a decrease in pool habitat resulting from declines in large woody debris input would cause a decline in fish habitat availability (Skeesick 1989).

Large woody debris available for input to the stream system is affected by past management practices, by previous fire history, and by the Shady Beach fire. Where past timber harvest did not provide adequate stream buffers, the potential for input of LWD is limited or nonexistent. Where past timber harvest provided stream buffers, the buffers left after harvest and fuel treatments range in effectiveness for LWD input from no potential to high potential. In areas of high fire intensity, in timber along streams or through stream buffers left from previous timber harvest, the potential for long-term input of LWD was reduced. In these areas, the potential for input of LWD is short-term, as the fire-killed trees fall. Long-term input of LWD would be eliminated until new stands become established and mature.

An effect of reduction in the recruitment of LWD into the aquatic system is a loss of pool habitat associated with large woody debris. Thirty to 40 percent of the pool habitat in Hills Creek should be in the form of LWD. Loss of LWD input can be translated into loss of pool habitat, which, in turn can be translated into potential loss of fish. For example, if 50 percent of the potential for LWD was lost, then the effect would be a potential loss of 15 to 20 percent of the pool habitat. Assuming a stocking level of 7,000 fish in Hills Creek, a direct loss of 50 percent of the product of 15 to 20 percent times 7,000 would equate to a potential loss of fish-holding capacity of from 525 to 700 fish (Skeesick 1989). These losses would be long-term reductions in fisheries productivity. For this calculation, it is assumed that prescribed stream buffers will provide 50 percent of the potential pool habitat that would be provided in an unmanaged stand.

Using the same process and assumptions as above, but using an optimal proportion of pool habitat of 50 to 60 percent for smaller fish-bearing streams (Skeesick 1989), losses in pool habitat for streams other than Hills Creek were derived. There is no estimation of losses in fish-holding capacity in (Class II and III streams) because fish population sizes in the tributary streams are unknown.

EFFECTS COMMON TO ALL ALTERNATIVES

Temperature

Water temperature is largely a function of the amount of sunlight impinging on the stream (Brown, 1970, 1972). Temperature increases are estimated by measuring the amount of riparian vegetation destroyed by fire or removed by harvest. This change in shade is then related to the amount of streamflow at a given site. For all alternatives, summertime temperatures of Class II and Class III streams flowing through burn areas are predicted to rise. These temperature increases will diminish by increments over the next 7 years, at which time the shade-producing vegetation will have recovered (Betchta and Taylor, 1988; Summers 1983). However, a study on the Willamette National Forest indicates that as long as 25 years may be required for streamside vegetation to recover completely (Stewart and others, 1981).

Maximum temperatures are not expected to be high enough to reduce dissolved oxygen levels below that necessary for maintenance of suitable occupancy by fish. There are no measurable changes in water temperature at Hills Creek Reservoir under any alternative, including the no action alternative. Predicted temperature increases in Hills Creek due to the fire are expected to be less than 1 degree F, and, therefore, changes in dissolved oxygen levels in Hills Creek as well as Hills Creek Reservoir can be assumed to be insignificant. Since maximum temperatures are expected to occur during the month of August (although higher than average August temperatures can occur any time from late June through September), insignificant effects on spawning and embryo development are expected. Effects on embryo development would occur if the timing of spawning was late in the spawning season or if high stream temperatures occurred over an extended period between June and August.

Streamflow Changes and ARP

A direct relationship has been shown to exist between clearcutting and increases in streamflow (Anderson and Hobba, 1959; Harr 1976; Christner 1981; and Harr 1986). Severe wildfire will increase streamflows, similar to that of clearcutting (Swanson 1981). For all of the action alternatives, aggregate recovery percentage (ARP) would be reduced from post-fire levels. This ARP reduction will cause small (0 to 5 percent) average streamflow increases. The ARP equation used by the Willamette National Forest predicts that after 28 years, planted conifer trees will have full crown closure, thus producing 100 percent ARP. All of the action alternatives plan to plant conifer trees in harvest areas. Streamflows will be reduced over time following ARP recovery. The 1,041 acres of privately owned lands that occur in Modoc, Kitson, and Tufti drainages are included in this analysis.

The magnitude of peak flow increases for streams in the burn area are estimated directly from the average flow increases. However, peak flows generated from rain-on-snow events could be much larger, up to 50 percent more than the average. A hypothetical 20-percent increase in flow from burn-area streams would correspond to a 3-percent increase in flow for Hills Creek.

Sediment Movement and Turbidity

Sediment yields carried by streams and stream turbidity have been increased substantially as a result of the fire. Suspended sediment and turbidity increases would largely occur during high flows of winter and spring when the majority of sediment movement takes place. Suspended sediment and turbidity were evaluated in this report from a Hills Creek flow of 140 cubic feet per second (cfs). Hills Creek flows are at or above 140 cfs about 55 percent of the days between November and June (see Figure IV-8 Hills Creek Hydrograph).

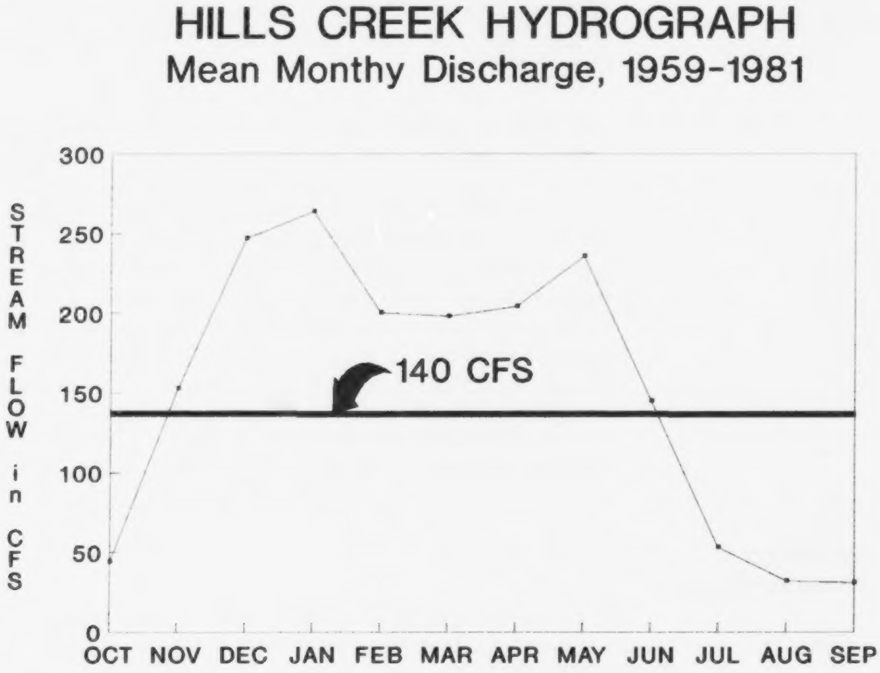


Figure IV-8 Hills Creek Hydrograph, mean monthly discharge, years 1959 to 1981

Of the total erosion produced, landslides or mass movements contribute 70 percent. Surface erosion, road-related erosion, and channel erosion comprise the remaining 30 percent. The potential for landslides, particularly on upland slopes, will increase as tree and shrub roots decay, reaching a peak 4 to 10 years after the burn. Unstable soil will again be stabilized to pre-fire levels when the root systems of sprouting hardwoods or planted conifers are fully established (Figure IV-9).

Turbidity results largely from the presence of fine-grained, clayey sediment in stream water. Increases of turbidity in this project area are correlated to increases in suspended sediment yield, and, therefore, the reduction in turbidity, over time, will follow the recovery of erosion rates and sediment yield (Figure IV-9).

Since high levels of turbidity occur in the winter and spring, there would be little measurable effect on the fisheries resource (the primary beneficial use) at the levels predicted. A large percentage of suspended sediment will pass through the stream system during winter high flows. Little effect on spawning gravels is expected, although the effect could be significant in the case of mass failure directly entering the stream system.

Post-fire baseline for erosion and temperature consists of natural background (pre-management) plus fire effects and does not include pre-fire management effects.

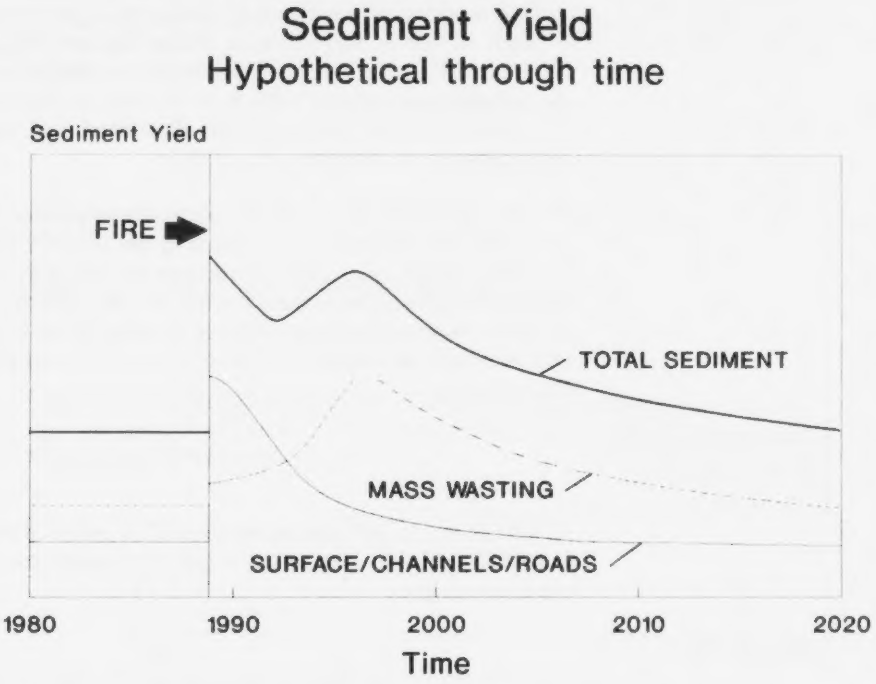


Figure IV-9 Hypothetical sediment yield through time for the Shady Beach fire area

Effects of sediment loading would be similar to effects discussed in Alternative E. However, additional increases in sediment delivery to the stream system would have a detrimental effect on fish-habitat capability until all of the stored sediment is flushed from the system. This is estimated to occur in 5 to 10 years. See the sediment movement and turbidity section under each alternative.

Hills Creek Reservoir

During the design of Hills Creek Reservoir, sediment yields for the entire watershed were estimated in order to predict the life of the reservoir (Youngberg and others, 1971). The U.S. Army Corps of Engineers estimated sediment yield of the area draining into the reservoir as 100 acre feet per year (161,333 cubic yards per year, cy/yr). This amount was stated to be insignificant when compared to the reservoir's dead storage volume of 107,000 acre feet (about 173 million cubic yards) (U.S. Army Corps of Engineers 1988).

Large Woody Debris

Approximately 16 percent of the stream length within the analysis area was burned intensely enough to remove or partially remove the stabilizing woody material. Where the fire burned through timber along streams or through stream buffers left after timber harvest the potential for long-term input of LWD was reduced where fire intensities were high. In these areas, the potential for input of LWD is short-term, as the fire-killed trees fall. Long-term input of LWD would be eliminated until new stands become established and mature.

The reduction of LWD in 16 percent of the stream length plus the reduction of future LWD sources would result in decrease of fish-habitat capability (Skeesick 1989). Reduced recruitment of LWD can result in increased sediment delivery, increased stream velocity, decreased sediment holding capacity, loss of pool habitat, loss of effective spawning habitat, and reduced aquatic food resources. Pre-fire and post-fire LWD potential is shown in Figure IV-10.

EFFECTS COMMON TO ALTERNATIVES B, C, D, AND F

All effects in this section are measured in terms of increases or decreases from Alternative E - No Action, which represents the current conditions of the analysis area.

Temperature

There would be no measurable changes in water temperature in Hills Creek under any of the action alternatives.

Streamflow Changes and ARP

The predicted effect on fish habitat from increases in average peak flows is a decrease in fish habitat capability in Hills Creek. Predicted reduction of large woody debris in Hills Creek is represented by increases in peak flow for each action alternative. Effects of these increases are discussed in the streamflow changes and ARP section under each alternative.

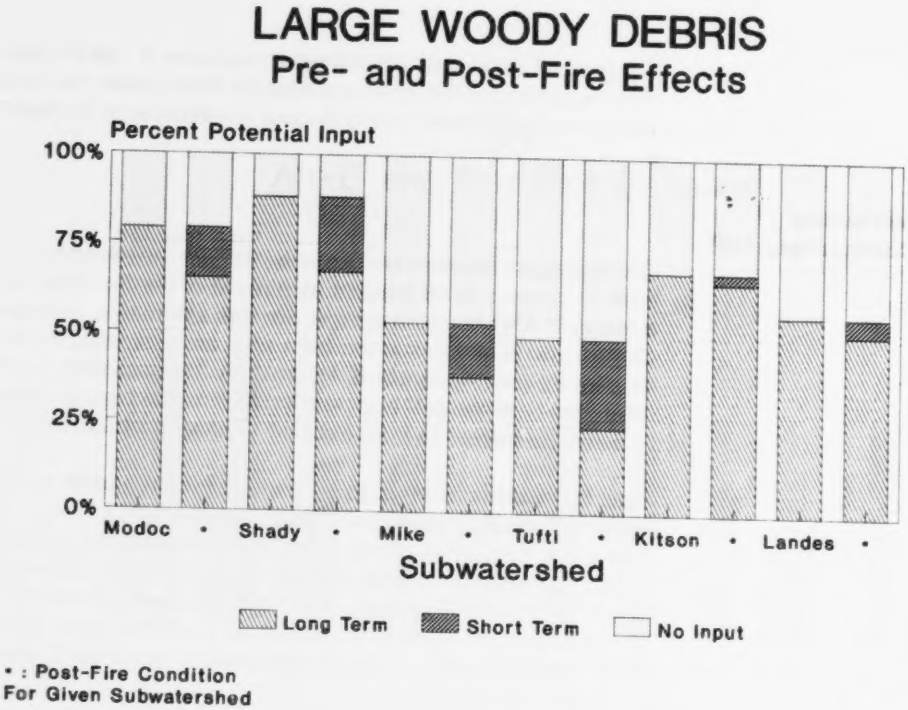


Figure IV-10 Large woody debris pre-fire and post-fire.

Sediment Movement and Turbidity

Figure IV-11 displays the percent of the predicted increases in erosion and corresponding sediment that comes from roads versus harvest for each action alternative.

Percent of Increase
by Alternative

Alternative	B	C	D	F
Roads	74	54	0	93
Harvest	26	46	100	7
Total	100	100	100	100

Figure IV-11 Percent of predicted increases in erosion/ sediment from roads versus harvest for each alternative

ALTERNATIVE E
NO ACTION

Temperature

Aggregate mean maximum temperature for Class II and III streams in the analysis area is 57.4 degrees F under this alternative. Temperature increases in individual Class II and Class III streams are estimated to increase up to

6 degrees F (Figure IV-12). However, because the burn area makes up only 15 percent of the drainage area for Hills Creek, the temperature increase of Hills Creek during August is estimated to be less than 1 degree F.

Streamflow Changes and ARP

The aggregate recovery percentage (ARP) for the analysis area was reduced from 60 percent to 48 percent as a result of the fire. See Figure IV-13 for a listing of ARP by subdrainage. For this alternative, average flows for Class II and III streams in the burn area are estimated to increase up to 14 percent (see Appendix B, Hydrology). This estimate is based on the difference between pre- and post-fire ARP for the burn area and is calibrated to flow-data increases from clearcut drainages observed by Harr (1976).

Peak flow increases of up to 50 percent for streams in the burn area are possible based on peak-flow increases observed in the H. J. Andrews Forest following clearcutting (Harr 1986). Since only 15 percent of the Hills Creek watershed was affected by the fire, this increase in peak flows would not have a significant effect on Hills Creek peak flows. Peak flows of this magnitude coming from streams in the fire area would create an estimated 8 percent increase in the peak flow of Hills Creek.

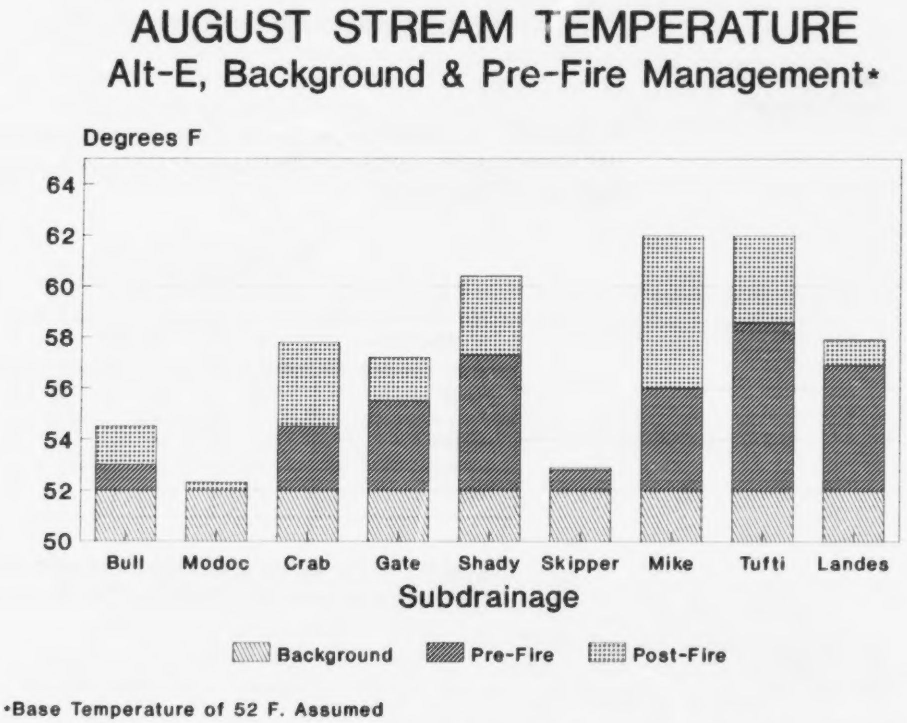


Figure IV-12 Stream temperature Alternative E, background and pre-fire management

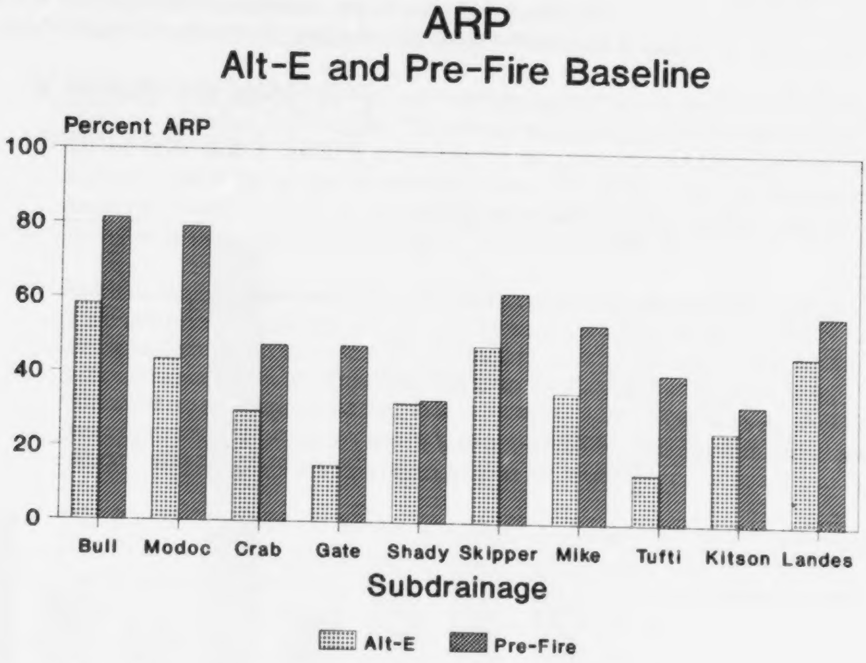


Figure IV-13 ARP for Alternative E and pre-fire baseline.

Sediment Movement and Turbidity

Stream-channel sediment yields are expected to increase as a result of increases in surface-soil erosion, channel erosion, and landslides. The potential for this eroded material to reach the stream channel is evaluated by an Erosion Index (see Appendix B, Hydrology). Fire related soil erosion would increase sediment yields for 7 to 10 years until vegetation can again stabilize the soil surface. Within the Class II and Class III streams, between 5 and 15 percent of the sediment would be stored for some time. This stored sediment would eventually be flushed from the system in 5 to 10 years. Fish habitat may be affected during this period.

During high flows, suspended sediment yields from streams draining the fire area are estimated to increase up to 10 times pre-fire levels. This estimate of suspended sediment is made from the Erosion Index (Figure IV-14) and has been verified by monitoring data collected during the winter and spring of 1989. Sediment yields 5 times higher than baseline levels have been reported from western Oregon watersheds following clearcutting and slash burning (Swanson and Dryness, 1975).

Sediment yield delivered to Hills Creek Reservoir from the fire area is estimated to increase from pre-fire levels by 779 cubic yards per year (cy/yr) (.49 acre feet). The burn area constitutes only 3.7 percent of the reservoir watershed. The sediment yield of the entire watershed is estimated by the U.S. Army Corps of Engineers at 100 acre feet per year (161,333 cy/yr), and therefore, this increase can be considered to be insignificant. The sediment increase from the burn area is expected for about 10 years. Sediment delivered to the reservoir resulting from the fire can be assumed to have an insignificant effect on the life of the reservoir.

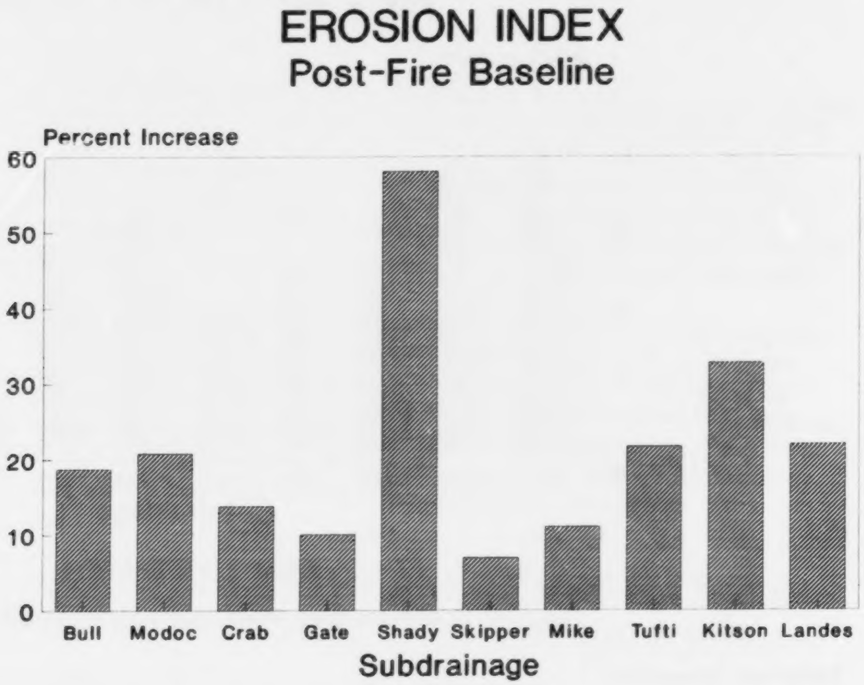


Figure IV-14 Post-fire baseline for erosion consists of natural background (pre-management) plus fire effects and does not include pre-fire management activities

Youngberg and others (1971) estimates that Hills Creek contributes only 12 percent of the reservoir turbidity. Turbidity increases from burn-affected streams are estimated to produce a turbidity increase for Hills Creek Reservoir of approximately 4 percent. Turbidity increases in Hills Creek Reservoir are expected to be passed on downstream to some extent because the reservoir outlets discharge from the lower, turbid zone (Youngberg and others, 1971; Appendix B, Hydrology). Turbidity increases are estimated to be insignificant (less than 3 percent) in the Middle Fork of the Willamette River because of sediment settling in the reservoir and downstream dilution. In the event of severe mass failure(s), there would be potential for significant increases in turbidity downstream from the Hills Creek Reservoir. This would be due to the proximity of the affected area to the Hills Creek Reservoir and the tendency for dense, sediment-laden water to accumulate in the lower, turbid zone of the reservoir where the outlet is located.

Fish

The predicted effect on the fisheries habitat from predicted, fire-caused increases in average and peak flows is a potential reduction of large woody material and the subsequent decrease in fish habitat quality in Hills Creek.

Increases in sediment loading and turbidity would have a potential negative effect on fisheries productivity. The actual effects in terms of reduced fish habitat is difficult to predict. What can be assumed is that there would be a detrimental effect on the spawning gravels until all of the stored sediment (between 5 percent and 15 percent of the predicted increases) is flushed from the system. This is estimated to occur in 5 to 10 years.

Post-fire august maximum temperatures during drought years or during prolonged periods of high air temperature will be higher than pre-fire temperatures for up to seven years. Under those conditions, some of the subdrainages in the fire area may become unsuitable for occupancy by fish and may be avoided by fish. Fish occupying such subdrainages during drought or extended hot periods may experience reduced appetite, reduced growth, weight loss, reduced reproduction, or mortality.

The effects of the fire on stream temperature can be expected to be significantly reduced, assuming no further disturbance, in 7 to 25 years due to expected growth of brush and small deciduous trees adjacent to Class II and III streams.

Large Woody Debris

The fire had an effect of reducing the potential for long-term recruitment of LWD into the aquatic system (see Figure IV-10). Many stream buffers which had moderate potential for long-term LWD input were reduced to short-term potential. A significant amount of unharvested timber stands along streams were also reduced to short-term potential by the fire.

Big Willow (21B) and Warfield (22D) subwatersheds were largely outside of the fire area and had no fire impact to their riparian LWD potential. Those subwatersheds that were affected are listed in Figure IV-15.

The reduction of green trees available for future LWD is offset by the increase in dead trees available for LWD in the short-term. Where long-term potential (green trees) was reduced to short-term potential (dead trees) or to no potential for LWD input, it may take 120 to 200 years for new trees to grow, mature and fall to the ground.

For Alternative E - No Action, there would be no change in pre-fire potential pool habitat or fish populations in Hills Creek. There would be a potential loss of 8 to 10 percent of pool habitat in small, fish-bearing streams relative to pre-fire conditions.

ALTERNATIVE E
LONG-TERM RECRUITMENT OF LWD
INTO AQUATIC SYSTEM

Subwatershed	Percent (%) Reduction
Modoc (21A)	23%
Shady Gate (22B)	21%
Mike (22C)	29%
Tufti (22P)	33%
Kitson (22Q)	1%
Landes (22R)	2%

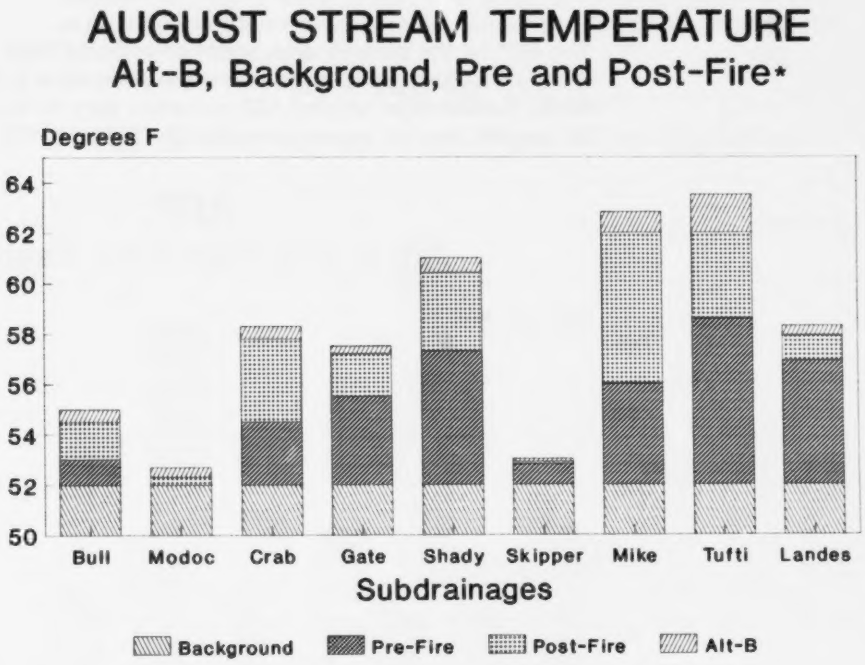
Figure IV-15 Long-term recruitment of LWD, Alternative E

ALTERNATIVE B

Implementation of this alternative is predicted to measurably affect the water quality of streams draining salvaged logged areas. Stream temperatures, erosion and corresponding sediment yields, and turbidities of subdrainage streams, Hills Creek, and Hills Creek Reservoir are all predicted to measurably increase as a result of Alternative B.

Temperature

Aggregate mean maximum temperature for Class II and III streams in the analysis area is 57.9 degrees F under this alternative. Stream temperature of all streams draining harvested areas is predicted to increase as there is minimal stream buffer mitigation in this alternative. For individual Class II and III streams, water temperature is predicted to increase up to 0.9 degrees F in addition to post-fire baseline temperatures (Figure IV-16). For streams already over 58 degrees F, this is a significant and measurable increase.



*Base Temperature of 52 F. Assumed

Figure IV-16 Stream temperatures of selected subdrainages for Alternative B, background, pre- and post-fire

Streamflow Changes and ARP

The ARP for the analysis area would be reduced from 48 percent in the post-fire baseline to 44 percent in Alternative B. The Modoc Creek subdrainage, with an ARP reduction from 43.3 percent to 30 percent, has the maximum reduction (Figure IV-17).

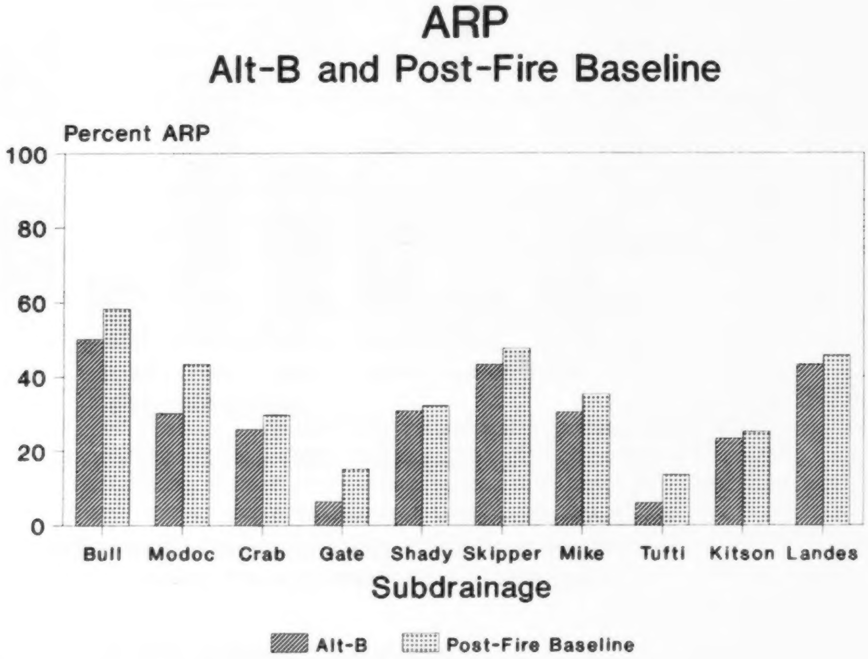


Figure IV-17 Change in ARP from post-fire baseline to Alternative B

Average flows for Class II and III streams are predicted to increase up to 5 percent in addition to post-fire levels, based on changes in ARP. Most average streamflow increases are predicted to be less than 3 percent in addition to post-fire levels. Increases in peak flows are of similar magnitude.

Sediment Movement and Turbidity

The extensive road building and clearcutting planned in Alternative B would cause detectable increases in erosion, sediment yields, and turbidity from post-fire baseline. Erosion Index values indicate that implementation of this alternative would have a high potential of generating detectable sediment and turbidity increases in three subdrainages (Figure IV-18). An average increase in the Erosion Index of 143 cy/yr above post-fire levels over the project area is predicted. The corresponding increase in sediment yield may result in a detectable increase in addition to post-fire levels in the average turbidity of some project area streams. Sediment yield increases would tend to occur during winter and spring high flows.

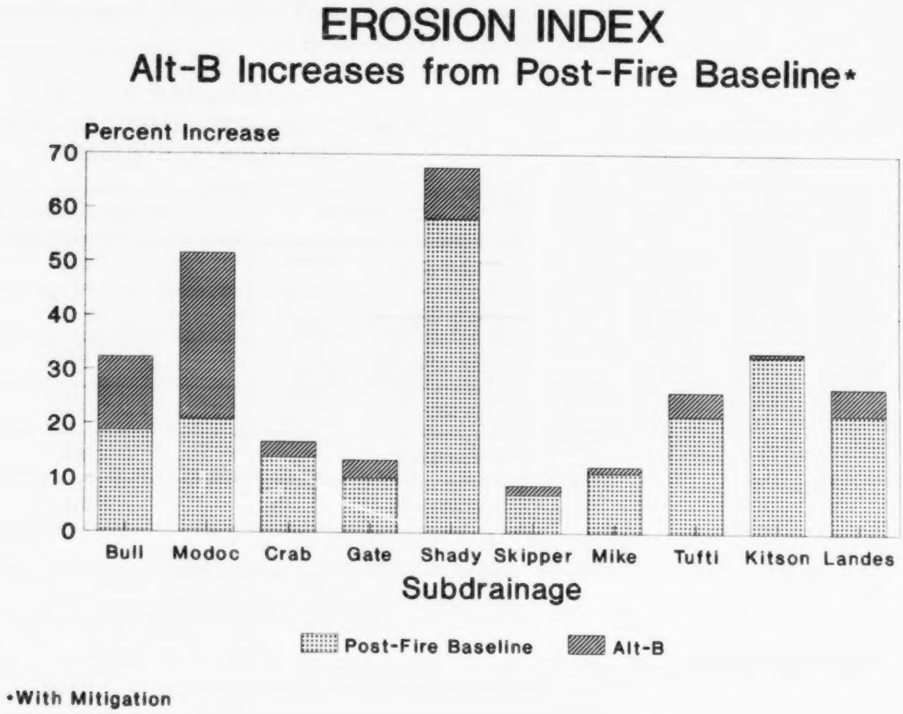


Figure IV-18 Erosion Index increases above post-fire baseline for Alternative B

As a result of Alternative B, sediment yield to Hills Creek Reservoir is predicted to increase by 121 cy/yr above post-fire levels. This estimate takes into account sediment storage along low gradient reaches of Hills Creek (see Appendix B, Hydrology). Turbidity increases in the reservoir are predicted to be less than 2 percent and are considered to be insignificant.

Fish

Effects of water temperature will be similar to effects discussed in Alternative E. However, additional increases in stream temperature, especially during March through August, would have a detrimental effect on fish reproduction, growth, health, and survival.

Large Woody Debris

Implementation of Alternative B would have results similar to Alternative C. However, there would be additional impacts to the stream buffers which would relate to further reductions in potential for long-term LWD input (Figure IV-19). These reductions are a result of removal of 75 percent of the volume out of stream buffers on Class I, II, and III streams.

For Alternative B, there would be a potential loss of 9 to 12 percent of pool habitat resulting in a loss of fish-holding capacity of 170 to 230 fish in Hills Creek. There would be a potential loss of 6 to 7 percent of pool habitat in small fish-bearing streams beyond the losses displayed in Alternative E.

ALTERNATIVE B
LONG-TERM RECRUITMENT OF LWD
INTO AQUATIC SYSTEM

Subwatershed	Percent (%) Reduction
Modoc (21A)	49%
Shady Gate (22B)	63%
Mike (22C)	9%
Tufti (22P)	13%
Kitson (22Q)	46%
Landes (22R)	6%

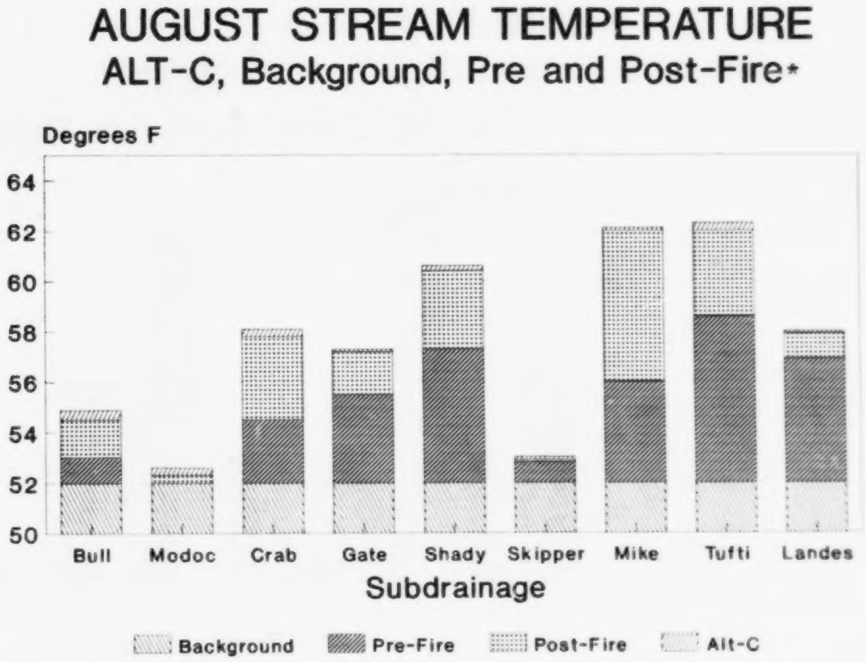
Figure IV-19 Percent reduction in long-term potential recruitment of LWD, Alternative B

ALTERNATIVE C

The cumulative effects of implementation of this alternative, with present mitigation prescriptions, would show a detectable increase in erosion and corresponding sediment yields, and turbidity in Class II and III streams draining harvested areas. Stream temperature increases are predicted to be insignificant.

Temperature

Aggregate mean maximum temperature for Class II and III streams in the analysis area is 57.5 degrees F under this alternative. Water temperatures of streams draining harvested areas are not predicted to increase measurably because shading vegetation would be retained in streamside buffers. An insignificant (unmeasurable) temperature increase is predicted and assumes a 10-percent shade loss estimated for skyline logging corridors which would cross stream buffers (Figure IV-20).



*Base Temperature of 52 F. Assumed

Figure IV-20 Stream temperatures of selected subdrainages for Alternative C, background, pre- and post-fire

Streamflow Changes and ARP

The ARP for the analysis area would be reduced from 48 percent in the post-fire baseline to 45 percent in Alternative C. The greatest reduction in ARP is predicted for the Modoc Creek drainage, (Figure IV-21) which shows a drop of 8 percent from the post-fire baseline.

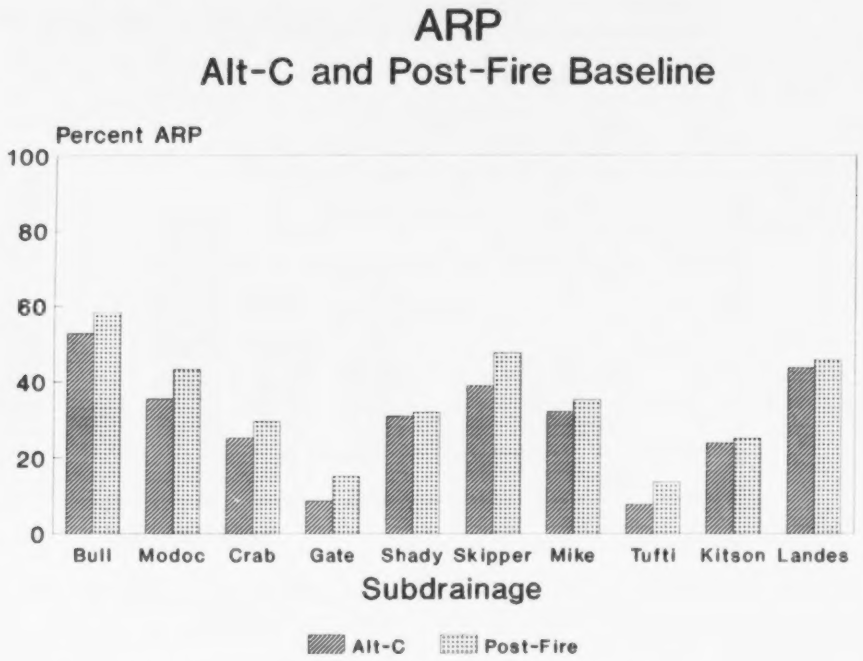


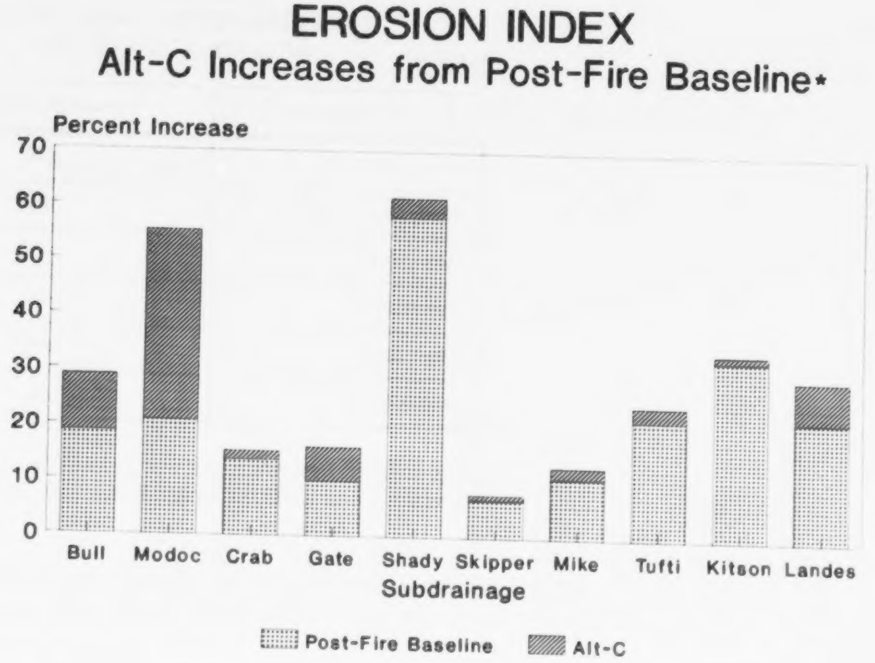
Figure IV-21 Change in ARP from post-fire baseline to Alternative C for selected subdrainages

Average streamflows for Class II and III streams are predicted to increase up to 4 percent above post-fire levels. Most streamflows, including Hills Creek, would increase less than 3 percent in addition to post-fire levels, which is considered to be an insignificant change. Increases in peak flows are of similar magnitude.

Sediment Movement and Turbidity

The predicted increases in erosion and corresponding increase in sediment yield, and turbidity for this alternative are due to salvage harvest and new road construction. The Erosion Index predicts potential detectable increases in Bull and Modoc subdrainages (Figure IV-22). The corresponding increase of suspended sediment yield for the analysis area is predicted to be 115 cy/yr above post-fire baseline.

Sediment yield to Hills Creek Reservoir is predicted to increase by 99 cy/yr above post-fire levels. Turbidity increases in the reservoir are predicted to be less than 2 percent, an insignificant effect.



*With Mitigation

Figure IV-22 Erosion Index increases above post-fire baseline for Alternative C

Fish

Effects on fish due to water temperature changes would be similar to the effects discussed in Alternative E.

Large Woody Debris

Implementation of Alternative C would result in reductions in long-term potential for LWD input as shown in Figure IV-23. These reductions in long-term potential are additional to the impacts of the fire itself. There would be increased areas with no potential for long-term woody debris input, resulting from harvest without buffers on some Class IV streams.

For Alternative C, there is a potential loss of 5 to 7 percent of pool habitat resulting in a loss of fish-holding capacity of 60 to 90 fish in Hills Creek. There is a potential loss of 5 percent of pool habitat in small fish-bearing streams beyond the losses displayed in Alternative E.

ALTERNATIVE C
LONG-TERM RECRUITMENT OF LWD
INTO AQUATIC SYSTEM

Subwatershed	Percent (%) Reduction
Modoc (22A)	14%
Shady Gate (22B)	16%
Mike (22C)	8%
Tufti (22P)	0%
Kitson (22Q)	46%
Landes (22R)	6%

Figure IV-23 Percent reduction in long-term potential recruitment of LWD, Alternative C

ALTERNATIVE D

Implementation of Alternative D would have an insignificant impact on the water quality of streams draining salvaged logged areas.

Temperature

Aggregate mean maximum temperature for Class II and III streams in the analysis area is 57.5 degrees F under this alternative. Water temperatures of Class II and III streams draining harvested areas would not increase significantly. Stream-side buffers prescribed in this alternative would preserve shade and therefore inhibit temperature rise. A 10 percent shade reduction for skyline logging corridors was assumed for stream buffers in harvest units.

Streamflow Changes and ARP

The ARP for the analysis area would be reduced from 48 percent in the post-fire baseline to 46 percent in Alternative D. A maximum subdrainage ARP reduction of 5 percent would occur in Modoc Creek (Figure IV-24).

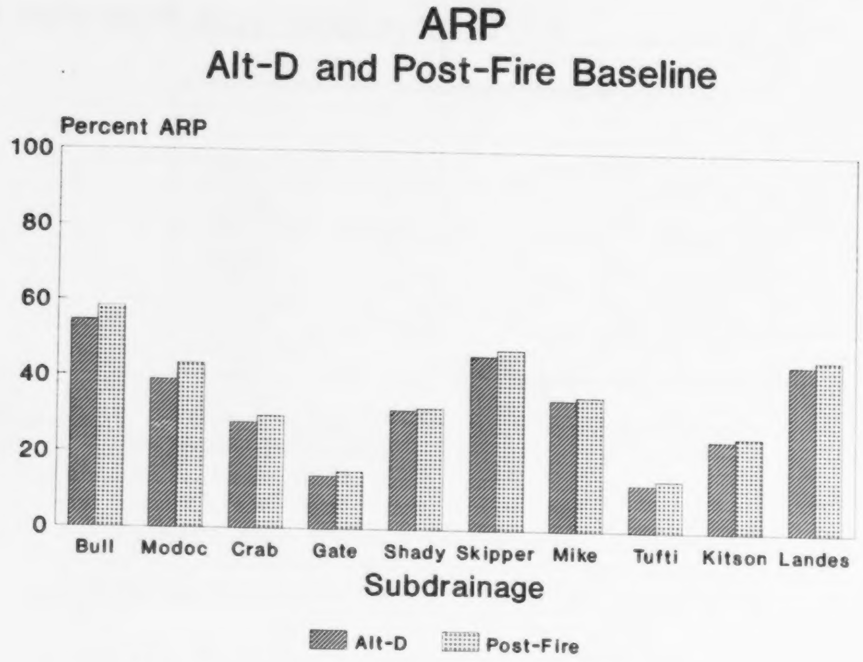


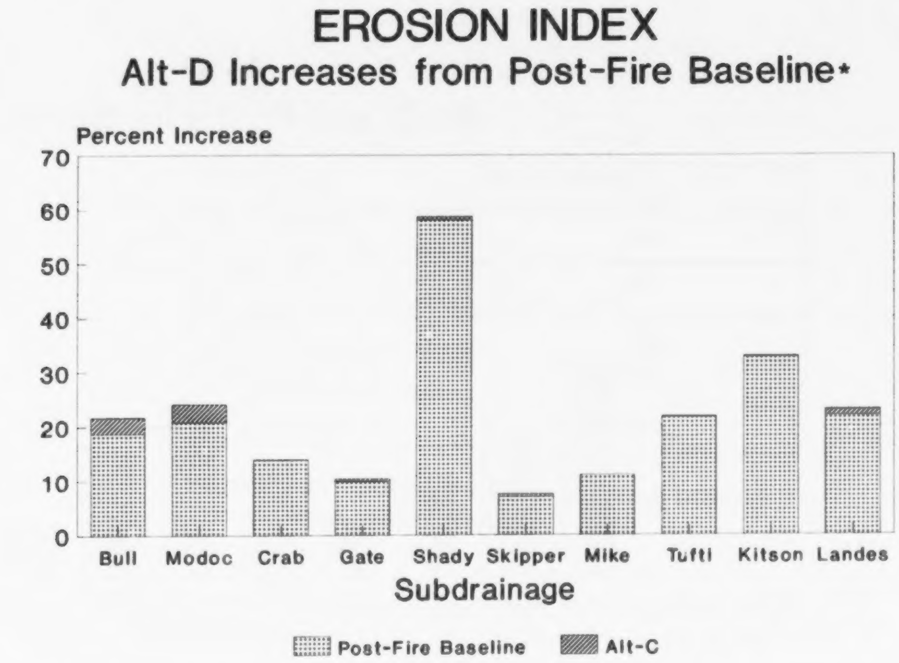
Figure IV-24 Change in ARP form post-fire baseline to Alternative D for selected subdrainages

Average flows for Class II and III streams are predicted to increase at most 4 percent above post-fire baseline. Increases in peak flows would be of similar magnitude.

Sediment Movement and Turbidity

Undetectable increases in sediment yield and turbidity are predicted for Alternative D above post-fire levels. The Erosion Index predicts undetectable increases in all but a few subdrainages which have increases that are barely detectable (Figure IV-25). The corresponding increase in suspended sediment of 18 cy/yr over post-fire levels is predicted for the analysis area. The increases in erosion and corresponding sediment yeild are insignificant.

Sediment movement into Hills Creek Reservoir is predicted to increase 16 cy/yr above post-fire levels. Turbidity increases in the reservoir would be less than 1 percent and are insignificant.



*With Mitigation

Figure IV-25 Erosion Index increases above post-fire baseline for Alternative D

Fish

Effects on fish due to water temperature changes would be similar to the effects discussed in Alternative E.

Large Woody Debris

Implementation of Alternative D would result in reductions in long-term potential for LWD input as shown in Figure IV-26. These reductions in long-term potential are additional to the impacts of the fire itself. There would be increased areas with no potential for long-term woody debris input, resulting from harvest without buffers on some Class IV streams.

There would be a potential loss of 5 to 7 percent of pool habitat resulting in a loss of fish-holding capacity of 60 to 90 fish in Hills Creek. There is a potential loss of 5 percent of pool habitat in small, fish-bearing streams beyond the losses displayed in Alternative E.

ALTERNATIVE D
LONG-TERM RECRUITMENT OF LWD INTO AQUATIC SYSTEM

Subwatershed	Percent (%) Reduction
Modoc (22A)	0%
Shady Gate (22B)	15%
Mike (22C)	8%
Tufti (22P)	0%
Kitson (22Q)	40%
Landes (22R)	6%

Figure IV-26 Percent reduction in long-term potential recruitment of LWD, Alternative D

ALTERNATIVE F

Implementation of this alternative would probably show detectable increases in sedimentation and turbidity in streams draining harvested areas. Stream temperatures would not increase significantly.

Temperature

Aggregate mean maximum temperature for Class II and III streams in the analysis area is 57.4 degrees F under this alternative. Stream temperature of all streams would not increase significantly because stream buffers prescribed in this alternative would preserve stream-side shade. Only a minor amount of shade reduction would result from skyline logging corridors across streams.

Streamflow Changes and ARP

The ARP for the analysis area would be reduced from 48 percent in the post-fire baseline to 46 percent if Alternative F were implemented. Most subdrainage ARPs would be reduced from 1 to 5 percent from post-fire baseline (Figure IV-27).

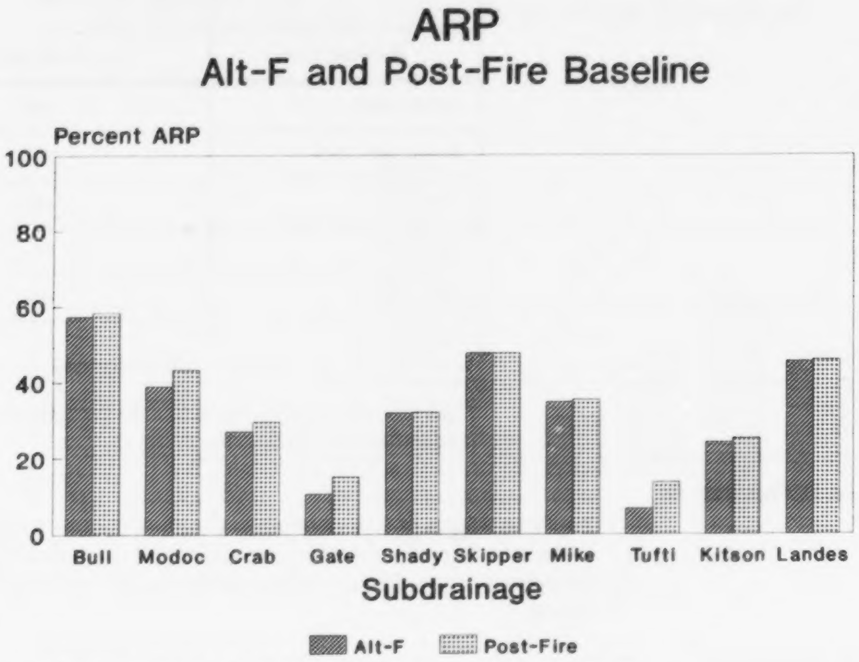


Figure IV-27 Change in ARP from post-fire baseline to Alternative F for selected subdrainages

Average streamflows for Class II and III streams are predicted to increase up to 3 percent above post-fire baseline levels. Peak flow increases are of similar magnitude.

Sediment Movement and Turbidity

During winter and spring high flows, increases in erosion and corresponding increases in sediment yield, and turbidity are predicted if Alternative F were implemented. The Erosion Index predicts dectable increases in Modoc and Shady Creek subdrainages (Figure IV-28). The corresponding increase in suspended sediment yield for the analysis area would be 67 cy/yr over post-fire levels.

As a result of Alternative F, the predicted sediment yield to Hills Creek Reservoir would increase by 53 cy/yr above post-fire levels. Turbidity increases in the reservoir above post-fire levels would be less than 1 percent.

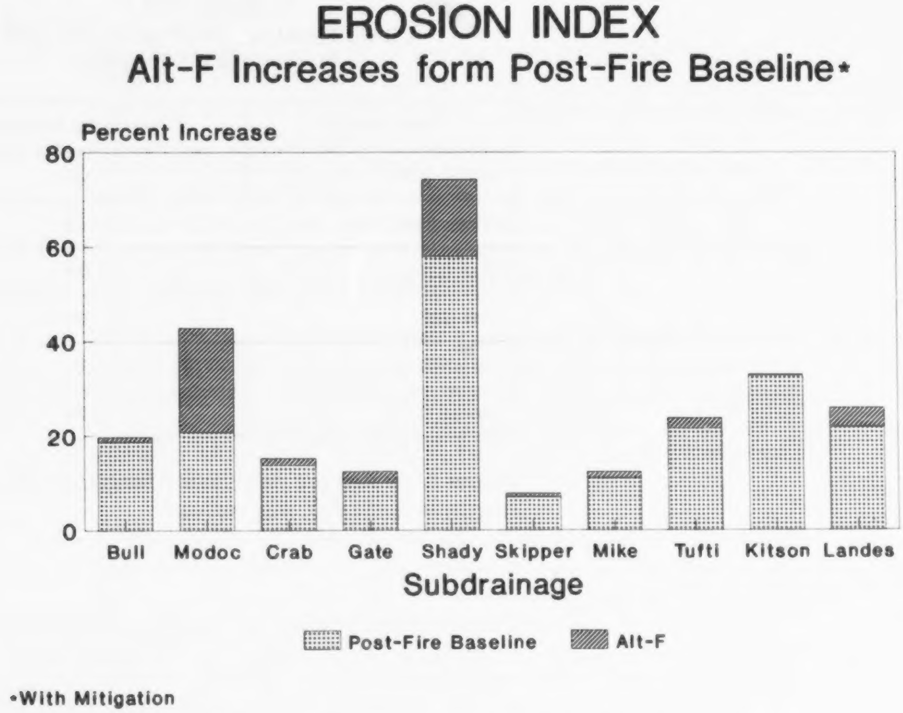


Figure IV-28 Erosion Index increases above post-fire baseline for Alternative F

Fish

Effects on fish due to water temperature changes would be similar to the effects discussed in Alternative E and are considered to be insignificant.

Large Woody Debris

Implementation of Alternative F would result in reductions in long-term potential for LWD input as shown in Figure IV-29. These reductions in long-term potential are additional to the impacts of the fire itself. There would be increased areas with no potential for long-term woody debris input, resulting from harvest without buffers on some Class IV streams.

For Alternative F, there would be a potential loss of less than one percent of pool habitat resulting in a loss of fish-holding capacity of less than one fish in Hills Creek. There would be a potential loss of less than one percent of pool habitat in small fish-bearing streams beyond the losses displayed in Alternative E. Reductions in fisheries capability for this alternative are considered to be insignificant.

ALTERNATIVE F
LONG-TERM RECRUITMENT OF LWD INTO AQUATIC SYSTEM

Subwatershed	Percent (%) Reduction
Modoc (22A)	0%
Shady Gate (22B)	5%
Mike (22C)	0%
Tufti (22P)	0%
Kitson (22Q)	1%
Landes (22R)	5%

Figure IV-29 Percent reduction in long-term potential recruitment of LWD, Alternative F

AIR QUALITY

The principal impact to air quality from prescribed burning and wildfires is the temporary visibility impairment caused by smoke. This may reduce the quality of forest recreation experiences. Vistas and panoramas normally enjoyed by Forest users could be temporarily obscured by smoke and haze. Rural communities could be inconvenienced by smoky conditions for relatively short periods of time. Fuels reduction activities emitting smoke are controlled by the Oregon State Department of Forestry to minimize the impact of smoke upon designated areas.

Wildfire smoke will also affect air quality and air quality-related values throughout the array of alternatives. Since the occurrence of wildfires is a random event in both time and space, the severity of the air-quality impact would vary depending upon projected fire intensity, fuel type and conditions, size of the fire, and meteorological conditions.

Prescribed fire emits less particulate material which affects visibility compared to the amount generated by wildfire. Prescribed fires consume less fuel per area than wildfire and therefore produce less particulates per unit of fuel (Cooper 1973). Emissions from burning have not been identified by the Environmental Protection Agency (EPA) as hazardous to human health (Cook and others, 1978), and no threshold limit or quantities have been set for compounds in forest smoke (Sandberg and others, 1979). Research has explored health hazards associated with the inhalation of smoke (Breysse 1984).

EFFECTS COMMON TO ALTERNATIVES B, C, D, AND F

Emissions resulting from burning of slash are temporary and affect visibility for short periods of time. The largest volume of suspended particulates would come from low-intensity prescribed burning which would occur primarily in the spring. Considerably less particulates would be generated from burning piled slash. This would occur primarily in the fall.

Quantities of smoke emitted by slash burning are regulated by the Oregon State Department of Forestry (OSDF) on a daily basis. A OSDF objective is to maintain the quality of the air in designated populated and scenic areas.

The amount of fuel burned during an available burning day is usually restricted. During an average 200-acre burning day, 1,000 tons of fine fuels would be consumed using low-intensity, prescribed burning techniques. There are no apparent conflicts between slash treatment proposals in these alternatives and State air quality objectives. Figure IV-30 shows estimated acres of treatment.

ESTIMATED ACRES OF TREATMENT

Alternative	Estimated Acres Treated By Prescribed Burn
Alternative B	1,941
Alternative C	1,875
Alternative D	1,405
Alternative F	1,253

Figure IV-30 Estimated acres treated by prescribed burning

ALTERNATIVE E
NO ACTION

Air quality is tied very closely to forest residue management. In this alternative, air quality will not be affected as no prescribed burning is planned. However, air quality degradation from wildfire is possible if the Shady Beach fire area reburns. See the Fire and Fuels section of this Chapter for a discussion on the probabilities of this area reburning in the future.

VEGETATION

Wildfire has a profound influence upon plant community development. The temperature, moisture, light, and nutrient availability of a given site as affected by the fire plays a significant role in predetermining which species can most effectively occupy an area.

FOREST STAND STRUCTURE

Harvesting fire-killed timber would have little long-term effect on vegetative composition. The re-occurring fire history in this area has perpetuated a complex of structurally diverse mature-to-over-mature (old-growth) stands which are dominated by a Douglas-fir canopy vertically arranged over a multi-layered intermediate stand. Short-term effects upon vegetative composition are a product of changes in the microsite and differences in species' abilities to compete for available site resources. Whether the site is artificially reforested or allowed to regenerate naturally will have a pronounced effect upon short-term future stand structure and composition. Subsequent forest management activities also have direct effects upon vegetation.

Old-Growth

For this analysis, stands greater than 200 years of age, with two to three canopy layers and with not more than 20 percent predicted mortality in the first crown layers are considered old-growth. Size of individual stands is not a factor in this analysis. The criteria were applied to all stands regardless of the forest climax type classification.

Since many of these stands have a high vertical structural diversity as a result of past fires, some amount of fire effects can occur without affecting the stands old-growth characteristics. These effects will be identified only within the burned area since there are no proposed activities that would affect old-growth conditions outside of that area.

REFORESTATION

Species, which are adapted to relatively harsh environments and which can compete with other species, frequently dominate post-fire stands for many years. Resprouting species and those which germinate from fire-stimulated seeds generally re-establish themselves within 1 to 3 years following such disturbance. Grasses and various shrubs such as buckbrush, deerbrush, Pacific madrone, golden chinquapin, big-leaf maple, vine maple, and hairy manzanita are the most likely species to become quickly established within the fire area. Conifers vary in their ability to revegetate fire-devastated areas. Seed-crop periodicity and site requirements for Douglas-fir will be discussed in depth as this species constitutes 90 percent of potential seed tree composition.

Heavy Douglas-fir seed crops generally occur at 5-to-7-year intervals. Between heavy seed crops, at least one crop failure usually occurs in addition to two or more light-to-medium crops. Fire has a pronounced effect upon the periodicity of Douglas-fir flowering by inducing stress crops of cones. Douglas-fir will germinate on almost any type of seed bed that provides adequate moisture and proper temperature. Moisture requirements are high, but the soil must be well drained. On good seed beds, a large number of viable seed will normally germinate, but about three-quarters of the seedlings usually die during the first year or two. Seedling mortality is caused by heat injury, drought, competition with other plants, frost, insects, disease (root rot/damping-off), and rodent feeding.

Incense cedar, ponderosa pine, and sugar pine will also naturally revegetate the areas provided an adequate seed source exists. Soil texture, plant competition, and the condition of the seedbed influences the survival of young seedlings of these species.

Artificial reforestation of indigenous conifers would be complicated by potential moisture stress, vegetative competition, excessive solar radiation, and animal damage. See Appendix C, Silviculture for a more complete discussion of reforestation implications (USDA Forest Service I988).

DETERIORATION OF FIRE-KILLED TIMBER

Factors affecting the rate of deterioration of fire-killed timber include species, diameter, temperature, aspect, and elevation. Species vary in bark thickness, wood-fiber strength, moisture content, percent of sapwood, and susceptibility to host specific attack of insects and fungi. Of the species found in the analysis area, western redcedar is the most resistant species to deterioration followed by incense cedar, Douglas-fir, sugar pine, ponderosa pine, hemlock, and the true firs.

Trees with small diameters (less than 20 inches) are extremely vulnerable to deterioration. Fungi will spread most rapidly in a moist, relatively warm environment (41 to 95 degrees F). This ideal environment is provided within the sapwood of recently dead trees.

Deterioration of fire-killed timber, in both volume and value, occurs over time with the most loss within the first three seasons. Smaller diameter trees deteriorate at a much faster rate as compared to larger diameter trees (see Figures IV-31 and IV-32). The smaller diameter trees loose approximately 70 percent of their volume in the first three seasons, whereas the larger diameter trees retain their volume for a longer period of time.

Appendix C, Silviculture contains more detailed information on volume and value losses in trees as they decay.

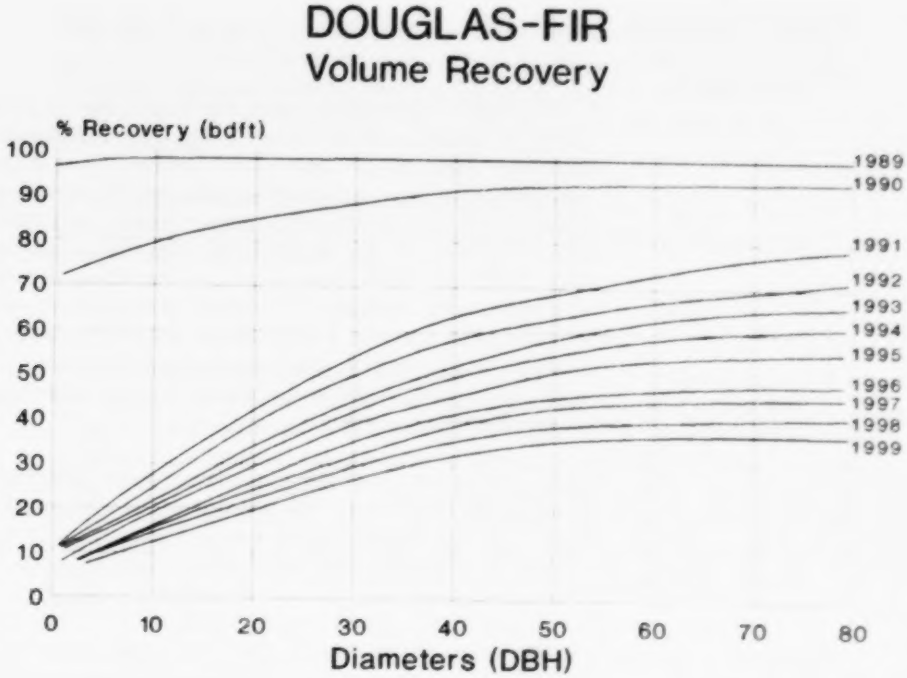


Figure IV-31 Douglas-fir volume recovery by tree diameter

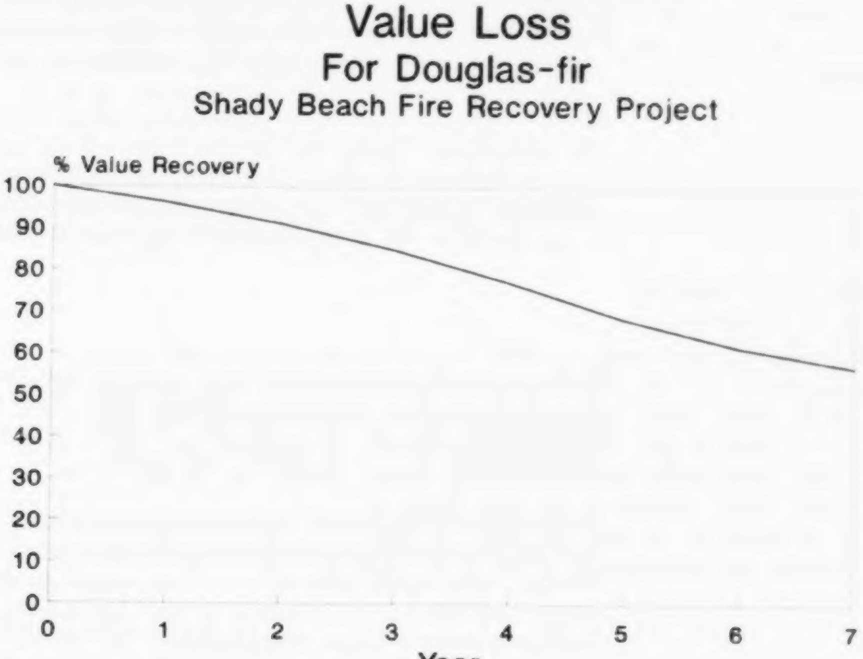


Figure IV-32 Value loss for Douglas-fir by time

EFFECTS COMMON TO ALL ALTERNATIVES

In the project and burned areas, there have been no threatened, endangered, or sensitive plants found during past inventories. Intensive plant inventories have not yet been done because most of the potential species have annual above-ground stems and are not easily seen in the fall and winter; in addition, much of the above ground vegetative material has been consumed by the fire. Random inventories have been conducted in 1979, 1980, and 1984. Prior to ground-disturbing activities, a survey would be conducted to evaluate occurrence of threatened, endangered, and sensitive plant species. If populations are found, mitigating actions would be taken to assure that management activities would not jeopardize the continued existence of these species or result in an adverse modification to their essential habitat.

Plant diversity has been enhanced thru seeding efforts during rehabilitation of the Shady Beach fire. The 700 acres that were aerially seeded with exotic species Annual wild rye grass (*Lolium spp*), Orchard grass (*Dactylis glomerata*), white dutch clover (*Trifolium repans*) would be dominated by these species, at least the first season, if germination of the seeding is successful. Native pioneer and secondary successional species would become established, sharing dominance with the exotic species by the second growing season and assuming dominance in the following seasons. Two of the exotic species, orchard grass and white dutch clover, may persist in some of the native plant communities adding to the plant diversity. It is believed that the treatment applied to this area would not inhibit the re-establishment of any sensitive plant species that may have grown here.

Approximately 1,795 acres of fire-damaged plantations would be planted with a variety of suitable tree species. Control of competing vegetation by such methods as the use of herbicides, manual cutting, or mulching may be necessary in some areas. Other protection and stand improvement measures will be implemented to enhance managed stand development.

EFFECTS COMMON TO ALTERNATIVES B, C, D, AND F

Outright mortality on lands not suited for timber production will be salvaged as authorized by the Code of Federal Regulations (CFR 1988a), Silvicultural Practices, Title 36, Chapter II Sec. 219.27 Item C (1,2). Unsuitable acreage will be planted, but not intensively managed.

As discussed in Appendix C, Silviculture, there is some potential for the population increase of several species of cambium and wood boring insects. These insects may be classed as primary or secondary. Primary insects can attack and kill trees of normal vigor but prefer stressed trees. Outbreaks are favored by drought periods and abundance of favorable breeding material (scorched timber, windthrow). To reduce the potential for successful primary insect attack upon healthy residual trees, dead and potentially dead timber should be removed immediately. Secondary insects are those that attack dead or dying trees and very often trees previously attacked by primary species. Although the population will definitely increase, it is estimated that there will be little negative effect upon live, healthy, undamaged trees by these various insects. Retention of wildlife trees suitable for nesting by birds such as woodpeckers, nuthatches, and creepers will ensure some natural biological control of these insects.

The structural diversity of the forest stands within the fire area has been reduced by the effects of the fire and further reduced by any alternative that would harvest green trees.

ALTERNATIVE E
NO ACTION

Plant succession under this alternative would parallel the succession of the subclimax, fire-perpetuated stands which existed prior to the fire. Post-fire plant succession is a product of changes in the environment and differences in species' capacities to develop within the altered environment. Less adapted species are eliminated from that community. Grasses (both annuals and perennials), buckbrush, deerbrush, pacific madrone, golden chinquapin, big-leaf maple, vine maple and hairy manzanita would be the most likely species to become established immediately within the fire area.

A common detriment to the establishment of all of the potential pioneer conifers (except incense cedar) is the relative intolerance to vegetative competition. Although individual conifers and islands of surviving trees will provide a seed source, this process is often too slow for successful competition with the hardwood sprouters and fire-stimulated seeders expected to dominate burned sites. Coniferous forest stands would develop slowly through the process of ecological succession.

Old-Growth

The 1,605 acres of old-growth in the fire area would be retained under Alternative E. This amount would persist until such time as it is deemed appropriate to enter the area with harvest activities.

Theoretical Volume Loss

Volume growth loss for the no action alternative comes from two sources, 1) the existing burned volume which is not harvested and 2) the volume growth loss due to the delayed reforestation and extensive management of timber. It is estimated that an irretrievable volume loss resulting from no salvage of fire mortality would approximate 148 MMBF gross merchantable volume. The volume growth loss due to delayed reforestation equates to 370 MMBF, for a total volume growth loss of 518 MMBF gross merchantable volume. See Appendix C, Stand Development and Growth section.

Sensitive Plant Effects

This alternative would have minimum effect on sensitive plant species that could occur in the area. Plant succession would occur without any further disruption after the fire and any sensitive plants that were eliminated by the fire would eventually re-establish themselves.

ALTERNATIVE B

This alternative would involve 3,001 acres of regeneration harvest (195 acres of shelterwood and 2,806 acres of clearcutting), 1,694 acres of partial cutting, and 1,633 acres of no cutting in mature stands within the fire area. Gross merchantable volume given each cutting prescription is summarized in Figure IV-33.

ALTERNATIVE B
GROSS MERCHANTABLE VOLUME

HARVEST PRESCRIPTION	DEAD VOLUME (MMBF)*	GREEN VOLUME (MMBF)*	DEAD VOLUME/ACRE (MBF/Acre)**	GREEN VOLUME/ACRE (MBF/Acre)**	TOTAL (MMBF)*
Regeneration Cut	121.3	24.5	40.3	8.2	145.8
Partial Cut	19.3	00.3	11.4	0.16	19.6
Total	140.6	24.8	22.9***	04.0***	165.4

* (MMBF) equals gross merchantable volume in million board feet.
** (MBF) equals gross merchantable volume in thousand board feet.
*** Weighted average by acres in each cutting prescription including the No Harvest acres.

Figure IV-33 Gross merchantable volume Alternative B

Approximately 195 acres of unsuitable timber lands with 100 percent outright mortality would be harvested.

Of the suitable timber lands harvested, 2,806 acres of regeneration harvest acres would be reforested with a variety of indigenous conifer species. Control of competing vegetation by such methods as the use of herbicides, manual cutting, or mulching may be necessary in some areas. Other protection and stand improvement measures would be implemented as necessary. See Appendix C, Silviculture for a discussion of reforestation concerns.

Regeneration Harvest Regime

The 3,001 acres of suitable timber land that would be regeneration harvested in this alternative would be reforested and cultured as presented under the stand development section in Appendix C for the proposed harvest and logging methods identified in Figures C-8 thru C-12. Harvest method, system and acres are displayed in Figure IV-34 as follows:

ALTERNATIVE B
REGENERATION HARVEST REGIME

Harvest Method	Harvest System	Acres
Clearcut Method	Conventional Harvest Systems	2,552 acres
Clearcut Method	Helicopter Harvest System	254 acres
Shelterwood Method	Conventional Harvest Systems	195 acres
Partial Cut Method	Conventional Harvest Systems	1,457 acres
Partial Cut Method	Helicopter Harvest System	237 acres
No Cut Regime		1,633 acres

Figure IV-34 Regeneration harvest regime for Alternative B

Old-Growth

Of the 1,605 acres containing old-growth characteristics within the fire area, approximately 1,413 acres would be harvested; mostly by partial cutting. This partial cutting would remove fire-killed trees from these old-growth stands and would affect about 88 percent of the old-growth forest in the fire area. This would be an irreversible effect if these acres would be managed as directed in the Proposed Forest Plan/DEIS, as rotation periods prescribed in that document would preclude the formation of old-growth characteristics in the future.

Theoretical Volume Loss

From a maximum recovery perspective, stands in which growth has culminated should be regeneration harvested. Greater growth and volume yield would be realized by regeneration harvesting a stand displaying declining growth and starting over than it is carrying a partially stocked stand over time. If all such stands were regeneration harvested and reforested, the greatest possible volume production over time would occur under this type of management regime. Theoretically, if maximum volume recovery were the sole resource concern, a total of 6,328 acres in the fire area would be regeneration harvested. This would yield 110 MBF per acre over an 80-year analysis period. This per-acre volume equates to a total of 694 MMBF gross merchantable volume over the analysis period. No alternative in this FEIS proposes this type of harvest regime.

In Alternative B, 3,001 acres would be regeneration harvested while 1,694 acres of partially stocked stands and 1,633 acres of stands left uncut would be retained. Projected volume under Alternative B for the 80-year analysis period is 92 MBF per acre for a total of 580 MMBF gross merchantable volume. Volume foregone when comparing the growth and yield of the theoretical maximum cutting prescription and Alternative B amounts to 18 MBF per acre over an 80-year analysis period. This per-acre, foregone volume equates to a loss of 114 MMBF gross merchantable volume over the analysis period.

Sensitive Plant Effects

The activities proposed in this alternative could have an adverse effect on much of the special plant habitats in areas where identified sensitive plant species could occur. About 72 percent (105 acres of rock openings and 2 acres wet meadow) of the 153 acres of special habitat could be affected by removal of adjacent sheltering trees, soil disturbance, or a change in soil moisture. Any sensitive species that may have been present could be reduced in vigor or possibly eliminated if sheltering trees at the edge of these sites are removed. Soil disturbance or changes in soil-water flow could exterminate plants or prevent them from being established in the future. Effects on existing sensitive plants would be mitigated as described in Chapter II, Mitigation and Enhancements Common to Alternatives B, C, D, and F, number 13.

The affects from a loss of sheltering trees would be somewhat long-term; development of a stand tall enough to shelter special habitat areas could take from 30 to 60 years. If soil loss and site desiccation occurred, the effect on plants would be long-term (100+ years).

ALTERNATIVE C

This alternative would involve 2,546 acres of regeneration harvest (188 acres of shelterwood and 2,358 acres of clearcutting), 2,063 acres of partial cutting, and 1,890 acres of no cutting. Gross merchantable volume given each cutting prescription is summarized in Figure IV-35.

ALTERNATIVE C
GROSS MERCHANTABLE VOLUME

HARVEST PRESCRIPTION	DEAD VOLUME (MMBF)*	GREEN VOLUME (MMBF)*	DEAD VOLUME/ACRE (MBF/Acre)**	GREEN VOLUME/ACRE (MBF/Acre)**	TOTAL (MMBF)*
Regeneration Cut	104.5	14.1	41.1	5.5	118.6
Partial Cut	25.4	00.0	12.3	00.0	25.4
Total	129.9	14.1	21.8***	02.3***	144.0

* (MMBF) equals gross merchantable volume in million board feet.
** (MBF) equals gross merchantable volume in thousand board feet.
*** Weighted average by acres in each cutting prescription including the No Harvest acres.

Figure IV-35 Gross merchantable volume Alternative C

Approximately 171 acres of unsuitable timber lands with 100 percent outright mortality would be harvested.

Regeneration Harvest Regime

The 2,375 acres of suitable timber land that would be regeneration harvested in this alternative would be reforested and cultured as presented under the stand development section of Appendix C for the proposed harvest and logging methods identified in Figures C-8 through C-12. Harvest method, system, and acres are displayed in Figure IV-36 following.

ALTERNATIVE C
REGENERATION HARVEST REGIME

Harvest Method	Harvest System	Acres
Clearcut Method	Conventional Harvest Systems	1,963 acres
Clearcut Method	Helicopter Harvest System	224 acres
Shelterwood Method	Conventional Harvest Systems	188 acres
Partial Cut Method	Conventional Harvest Systems	1,739 acres
Partial Cut Method	Helicopter Harvest System	324 acres
No Cut Regime		1,890 acres

Figure IV-36 Regeneration harvest regime for Alternative C

Old-Growth

Approximately 1,389 acres of old-growth forest would be harvested, mostly by partial cutting fire-killed trees. This represents about 86 percent of the old-growth stands in the fire area. Removal of dead trees would remove some of the structural components of old-growth. The potential for recovery of old-growth structural components would be retained in areas of partial cutting while that same potential would be lost for 175 to 250 years in clearcut harvest areas. This would be an irreversible effect if these acres would be managed as directed in the Proposed Forest Plan/DEIS, as rotation periods prescribed in that document would preclude the formation of old-growth characteristics in the future.

Theoretical Volume Loss

In Alternative C, 2,375 acres would be regeneration harvested while 2,063 acres of partially stocked stands and 1,890 acres of stands left uncut would be retained. Projected volume under Alternative C for the 80-year analysis period is 89 MBF per acre for a total of 563 MMBF gross merchantable volume. Volume foregone when comparing the growth and yield of the theoretical maximum cutting prescription and Alternative C amounts to 21 MBF per acre over an 80-year analysis period. This per-acre, foregone volume equates to a loss of 131 MMBF gross merchantable volume over the analysis period.

Sensitive Plant Effects

The activities proposed in this alternative could have an adverse effect on much of the special habitats in areas where sensitive species could occur. About 76 percent (114 acres of rock opening and 2 acres wet meadow) of the acres of special habitat could be affected by removal of adjacent sheltering trees, soil disturbance, or a change in water-table levels. Any sensitive species that may have been present could be reduced in vigor or possibly eliminated if sheltering trees at the edge of these sites were removed. Soil disturbance or changes in soil-water flow could exterminate plants or prevent them from being established in the future. Effects on existing sensitive plants would be largely avoided by the mitigation measures described for threatened, endangered, and sensitive plants in Chapter II. Mitigation may include such measures as directional falling away from special habitat areas, full log suspension over these areas, and the retention of a no harvest buffer around areas that contain sensitive plants. The effects on special habitats from a loss of sheltering trees would be somewhat long-term; development of a stand tall enough to shelter special habitat areas could take from 30 to 60 years. If soil loss and site desiccation occurred, the effect on plants would be long-term (100+ years).

ALTERNATIVE D

This alternative would involve 1,989 acres of regeneration harvest (98 acres of shelterwood and 1,891 acres of clearcutting), 2,713 acres of partial cutting, and 1,626 acres of no cutting. Gross merchantable volume given each cutting prescription is summarized in Figure IV-37.

ALTERNATIVE D
GROSS MERCHANTABLE VOLUME

HARVEST PRESCRIPTION	DEAD VOLUME (MMBF)*	GREEN VOLUME (MMBF)*	DEAD VOLUME/ACRE (MBF/Acre)**	GREEN VOLUME/ACRE (MBF/Acre)**	TOTAL (MMBF)*
Regeneration Cut	90.6	0.00	45.5	0.00	90.6
Partial Cut	42.7	00.0	15.6	00.0	42.7
Total	133.3	0.00	27.1***	00.0***	133.3

* (MMBF) equals gross merchantable volume in million board feet.
** (MBF) equals gross merchantable volume in thousand board feet.
*** Weighted average by acres in each cutting prescription including the No Harvest acres.

Figure IV-37 Gross merchantable volume Alternative D

Approximately 156 acres of unsuitable timber lands with 100 percent outright mortality would be harvested.

Regeneration Harvest Regime

The 1,833 acres of suitable timber land that would be regeneration harvested would be reforested and cultured as presented under the stand development section of Appendix C for the proposed harvest and logging methods identified in Figures C-8 through C-12. Harvest method, system and acres are displayed in Figure IV-38 which follows.

ALTERNATIVE D
REGENERATION HARVEST REGIME

Harvest Method	Harvest System	Acres
Clearcut Method	Conventional Harvest Systems	700 acres
Clearcut Method	Helicopter Harvest System	938 acres
Shelterwood Method	Conventional Harvest Systems	195 acres
Partial Cut Method	Conventional Harvest Systems	1,198 acres
Partial Cut Method	Helicopter Harvest System	1,515 acres
No Cut Regime		1,626 acres

Figure IV-38 Regeneration harvest regime for Alternative D

Old-Growth

Although the direction for this alternative is to harvest dead trees only, any removal of the mortality in old-growth stands would drastically reduce or eliminate most old-growth stand characteristics. Removal of dead trees would remove some of the structural components of old-growth. The potential for recovery of old-growth structural components would be retained in areas of partial cutting while that same potential would be lost for 175 to 250 years in clearcut harvest areas. Approximately 1,237 acres of old-growth forest would be partial cut harvested, about 77 percent of the old-growth that exists in the fire area. This would be an irreversible effect if these acres would be managed as directed in the Proposed Forest Plan/DEIS, as rotation periods prescribed in that document would preclude the formation of old-growth characteristics in the future.

Theoretical Volume Loss

In Alternative D, 1,833 acres would be regeneration harvested while 2,713 acres of partially stocked stands and 1,626 acres of stands left uncut would be retained. Projected volume under Alternative D for the 80-year analysis period is 87 MBF per acre for a total of 548 MMBF gross merchantable volume. Volume foregone when comparing the growth and yield of the theoretical maximum cutting prescription and Alternative D amounts to 23 MBF per acre over an 80-year analysis period. This per-acre, foregone volume equates to a loss of 146 MMBF gross merchantable volume over the analysis period.

Sensitive Plant Effects

The activities proposed in this alternative could have an adverse effect on some of the special habitats in areas where sensitive species would occur. About 41 percent (62 acres of rock opening and 2 acres wet meadow) of 153 acres of special habitat could be affected by removal of adjacent sheltering trees, soil disturbance, or a change in soil moisture. Any sensitive species that may have been present could be reduced in vigor or possibly eliminated if sheltering trees at the edge of these sites are removed. Soil disturbance or changes in soil-water flow could exterminate plants or prevent then from being established in the future. These potential effects on existing sensitive plants would be largely avoided by the mitigation measures described for threatened, endangered, and sensitive plants in Chapter II. Mitigation may include such measures as directional falling away from special habitat areas, full log suspension over these areas and the retention of a no-harvest buffer around areas that contain sensitive plants.

The effect of a loss of sheltering trees would be somewhat long-term; development of a stand tall enough to shelter special habitat areas could take from 30 to 60 years. If soil loss and site desiccation occurred, the effect on plants would be long-term (100+ years).

ALTERNATIVE F

This alternative would involve 1,987 acres of regeneration harvest (67 acres of shelterwood and 1,920 acres of clearcutting), 579 acres of partial cutting, and 3,762 acres of no cutting. Gross merchantable volume given each cutting prescription is summarized in Figure IV-39.

ALTERNATIVE F
GROSS MERCHANTABLE VOLUME

HARVEST PRESCRIPTION	DEAD VOLUME (MMBF)*	GREEN VOLUME (MMBF)*	DEAD VOLUME/ACRE (MBF/Acre)**	GREEN VOLUME/ACRE (MBF/Acre)**	TOTAL (MMBF)*
Regeneration Cut	81.0	05.0	40.8	02.5	86.0
Partial Cut	10.2	00.0	17.6	00.0	10.2
Total	91.2	05.0	14.8***	00.0***	96.2

* (MMBF) equals gross merchantable volume in million board feet.

** (MBF) equals gross merchantable volume in thousand board feet.

*** Weighted average by acres in each cutting prescription including the No Harvest acres.

Figure IV-39 Gross merchantable volume Alternative F

Approximately 137 acres of unsuitable timber lands with 100 percent outright mortality would be harvested.

Regeneration Harvest Regime

The 1,850 acres of suitable timber land that would be regeneration harvested in this alternative would be reforested and cultured as presented under the Stand Development section of Appendix C for the proposed harvest and logging methods identified in Figures C-8 through C-12. Harvest method, system and acres are presented in Figure IV-40 as follows:

ALTERNATIVE F
REGENERATION HARVEST REGIME

Harvest Method	Harvest System	Acres
Clearcut Method	Conventional Harvest Systems	1,615 acres
Clearcut Method	Helicopter Harvest System	168 acres
Shelterwood Method	Conventional Harvest Systems	67 acres
Partial Cut Method	Conventional Harvest Systems	445 acres
Partial Cut Method	Helicopter Harvest System	134 acres
No Cut Regime		3,762 acres

Figure IV-40 Regeneration harvest regime for Alternative F

Old-Growth

Approximately 318 acres of old-growth forest would be harvested, mostly by partial cutting of fire-killed trees. This represents about 20 percent of the old-growth that exists in the fire area. Removal of dead trees would remove some of the structural components of old-growth. The potential for recovery of old-growth structural components would be retained in areas of partial cutting while that same potential would be lost for 175 to 250 years in clearcut harvest areas. This would be an irreversible effect if these acres would be managed as directed in the Proposed Forest Plan/DEIS, as rotation periods prescribed in that document would preclude the formation of old-growth characteristics in the future.

Theoretical Volume Loss

In Alternative F, 1,987 acres would be regeneration harvested while 579 acres of partially stocked stands and 3,762 acres of stands left uncut would be retained. Projected volume under Alternative F for the 80-year analysis period is 77 MBF per acre for a total of 490 MMBF gross merchantable volume. Volume foregone when comparing the growth and yield of the theoretical maximum cutting prescription and Alternative F amounts to 40 MBF per acre over an 80-year analysis period. This per-acre, foregone volume equates to a loss of 204 MMBF gross merchantable volume over the analysis period.

Sensitive Plant Effects

The activities proposed in this alternative could have an adverse effect on some of the special habitats in areas where sensitive species could occur. About 53 percent (80 acres of rocky openings and 2 acres wet meadow) of the 153 acres of special habitat would be affected by removal of adjacent sheltering trees, soil disturbance, or a change in water-table levels. Any sensitive species that may have been present could be reduced in vigor or possibly eliminated if sheltering trees at the edge of these sites are removed. Soil disturbance or changes in soil-water flow could exterminate plants or prevent then from being established in the future. These potential effects on existing sensitive plants would be largely avoided by the mitigation measures described for threatened, endangered, and sensitive plants in Chapter II. Mitigation may include such measures as directional falling away from special habitat areas, full-log suspension over these areas and the retention of a no harvest buffer around areas that contain sensitive plants.

The effects from a loss of sheltering trees would be somewhat long-term; development of a stand tall enough to shelter special habitat areas could take from 60 to 100 years. If soil loss and site desiccation occurred, the effect on plants would be long-term (100+ years).

FIRE AND FUELS

FIRE

For any fire, the final size and severity is the result of many factors, the first being the probability of a fire starting in a given area. The Shady Beach project area has historically incurred four fires per year (a 15-year average), two ignited by lightning and two human-caused. Once an ignition occurs, the ease of control is another factor that affects a fire's size and severity. Many variables must be considered. Primarily these are weather, fuels, and the effectiveness of available suppression resources.

Fire-planning efforts incorporate additional factors such as the fire history of an area, past and present fuels management practices, weather history, and resource values at risk which are considerations for establishing a cost-effective mixture of suppression resources.

A certain amount of risk-taking is included in this decision-making process. Current fire planning centers on the ability of suppression forces to effectively control 90 percent of the wildfire occurrences. This process assumes that 10 percent of wildfire occurrences will not be immediately suppressed because of extraordinary circumstances.

FUELS

Fuels management is a process of managing risk in relation to the size and severity of a potential fire event. The objective of fuels management is to reduce the fire hazard to a level where cost effective resource protection is possible should a wildfire ignition occur.

Important fuel characteristics which contribute to the size and severity of a fire event are: amount (loading, described as tons per acre), size, arrangement, continuity (horizontal and vertical), and moisture content.

Fuel characteristics, especially loading, play a very important role in the effectiveness of suppression forces and the effects of the fire on the environment. Generally, control difficulty and potential damage to the environment increase as fuel-loadings increase. Potential future fire effects are directly related to fuel loading. The greater the fuel loading, the greater the effect on the environment.

EFFECTS COMMON TO ALL ALTERNATIVES

The conditions necessary to generate another fire similar in size to the Shady Beach fire would occur when fuel loading and continuity are sufficient to sustain a high-intensity fire and when weather conditions are similar to those that occurred during September of 1988.

Published fuel models and the Behave Computer Program have been utilized to predict the size of a future wildfire, following vegetative changes occurring both naturally and as the result of salvaging various quantities of timber in given periods of time. The assumptions used in Figures IV-41 through IV-43 are representative of the conditions experienced on a late summer day with a light upslope wind (90 percent chance of occurrence).

Lightning-caused fires are expected to continue to occur at a rate above the historical average of two per year depending upon the amount of fire-killed timber (snags) left standing.

Heavy fuel loadings can also inhibit reforestation activities. Also, fuel loading, among other factors can determine fire intensity and rate of spread, which, in turn, can affect soil productivity.

EFFECTS COMMON TO ALTERNATIVES B, C, D, AND F

Harvest activities will shorten the time it would take to change the existing NFFL Fuel Model 8 to a Model 12 in clearcuts and to a Model 11 in partial cuts. Within the Analysis area, selected fuel complexes (natural and created) would be treated to produce a fuel mosaic which would reduce fuel continuity and protect resources in critical areas.

The potential for a fire occurrence outside of the proposed harvest areas must be considered in planning fuel treatments for the project area. Fire-killed areas that are not harvested could experience greater fuels buildup over time than treated, salvage harvest areas. By treating areas where salvage takes place, overall fuel continuity for the project area would be reduced.

Due to the difficulty in predicting post-harvest fuel loadings and resultant fire behavior characteristics, on-site reviews will establish whether fuel treatment of hazard fuels are warranted. Disposal of logging slash is an investment which would be evaluated before treatment occurs. This evaluation would consider site preparation and resource risk management needs.

An array of fuel treatments are considered, varying from broadcast burn to no treatment. Other fuel treatments include hand piling, underburning, spot and strip burning, and extra protection of units that are not treated. Spatial orientation of treatment prescriptions would create a fuel mosaic (fuel breaks), interrupting overall fuel continuity. Strategically located harvest units, which would assist in preventing re-occurring large wildfires, were considered during development of alternatives. Other units adjacent to natural or created fuel break barriers would not be treated.

The objective of fuel treatment and retention of organic material are often viewed as conflicting, but this is not necessarily the case. The objective of retaining adequate levels of organic material is to maintain long-term site productivity. To ensure retention of adequate organic material through the next rotation, the area must be in a condition allowing efficient protection from successive fires. As discussed previously, fine fuels are essential to the spread of wildfires, therefore fuel treatment plans need to be developed which remove fine fuels but retain larger organic material. When fine fuels are treated and larger material is retained, fuel loadings greater than the absolute amounts prescribed under current guidelines (45 tons/acre) may occur, even though the hazard of future wildfire would be appropriately reduced.

ALTERNATIVE E NO ACTION

Reburns of large fire areas have been documented to occur approximately 10 to 20 years after the original fire. Examples from Oregon are the Yacolt Fire (1902) and the Tillamook Fire (1933). These reburn fires occurred in undisturbed sites, where the natural breakdown of the fire-killed stands resulted in high fuel loadings, and in areas where salvage operations left large accumulations of fuel (in the form of untreated slash). Using history as a guide, the Shady Beach fire area could reburn some time in the future if natural processes are allowed to prevail.

Fuel Loading and Fire Behavior

Ground fuels would remain unchanged for the first few years. Fire-killed, merchantable timber would remain on site and other dead aerial (above-ground) fuels consisting of conifer tops, branches, hardwood trees, brush, poles, and pre-fire snags would be left standing.

Fuel loading would be dynamic over time. As nature begins the decay processes, twigs, branches, and trees boles would fall to the ground. In 1 to 3 years, this light layer of needles and small branch wood would be represented by NFFL Fuel Model 8. These fuels could support a low-intensity fire. Simultaneously, in areas that were intensely burned, sunlight reaching the forest floor will stimulate growth of grass and brush. Where a seed source exists, reproduction would be re-established. The fuel bed under this condition is best represented by NFFL Model 5 (3 to 10 years). A fire in this type of fuel would be carried by brush and reproduction on the forest floor and would be intense enough to cause crowning and spotting.

Aerial fuels, tree branches and boles, would continue to succumb to natural processes and fall to the forest floor. Continued fuel accumulation would move the fuel toward NFFL Model 11, (5 to 25 years) where fires would be more difficult to control than for NFFL Model 8.

Further into the future, as the new stand approaches maturity, fuel loadings would continue to increase as the fire-killed stands further deteriorate, incorporating larger and greater amounts of fuel on the forest floor. Fuel models would progress toward NFFL Model 10, (20 to 45 years) and eventually to NFFL Model 12, (40 to 90 years) as more of the dead stand falls to the ground. Fires burning in these fuel models would be high-intensity fires.

The deterioration of a fire-killed stand of trees creates horizontal continuity to the ground fuels while the remaining standing fire-killed timber adds vertical continuity. The combination of heavy fuel loading and horizontal and vertical fuel continuity present the potential for extreme fire behavior.

This alternative poses the greatest increase in lightening-caused ignitions and suppression difficulties due to the higher snag densities that will be present.

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In the near future, with light fuel accumulations on the forest floor (NFFL Model 8), fire spread would be limited by the lack of fuel continuity, thus limiting the affected area. A low-intensity fire would damage reproduction and resprouted brush. Soil would be minimally affected.

As fuel loadings increase to those values representative of NFFL Models 10 and 12, reburn of the fire area would most likely be high-intensity over more of the area than the original fire.

ALTERNATIVE B

Intensive mortality salvage would significantly affect fuels in the area through generation of residue by timber harvest and subsequent fuels-reduction treatments. Ground-fuel loadings are directly related to harvest volume per acre; higher volumes generate higher fuel loadings. The wildfire hazard would be extreme in the year following harvest and prior to fuel treatment.

Fuel reduction for each harvest unit ranges from no treatment to complete treatment. Specific fuel treatments were selected based on strategic locations and site-specific information. Predicted fuel treatments for this alternative include hand piling of slash (65 acres, 1 percent), and low-intensity prescribed burning (2,265 acres, 48 percent). Completion of these activities would be needed to adequately protect forest resources and plantation investments from potential wildfire damage.

Fuels on most partial cut acres would not be treated in order to enhance site productivity, wildlife habitat, and hillside and stream-channel erosion resistance. Continuous fuels not treated in clearcut areas could constitute a significant localized fuel hazard. This hazard would remain at a high level for about 5 years then decline, over time, but would persist at a low level for 2 decades.

The probability or risk of a fire occurring in an untreated area would be 7.5 percent per year, with a potential extent of 45 acres per occurrence. Fire size would be 3.4 acres within one-half hour (see Figure IV-41) and fire intensities would be high, causing significant crowning and spotting activity. Hand crews would not be able to directly attack the fire.

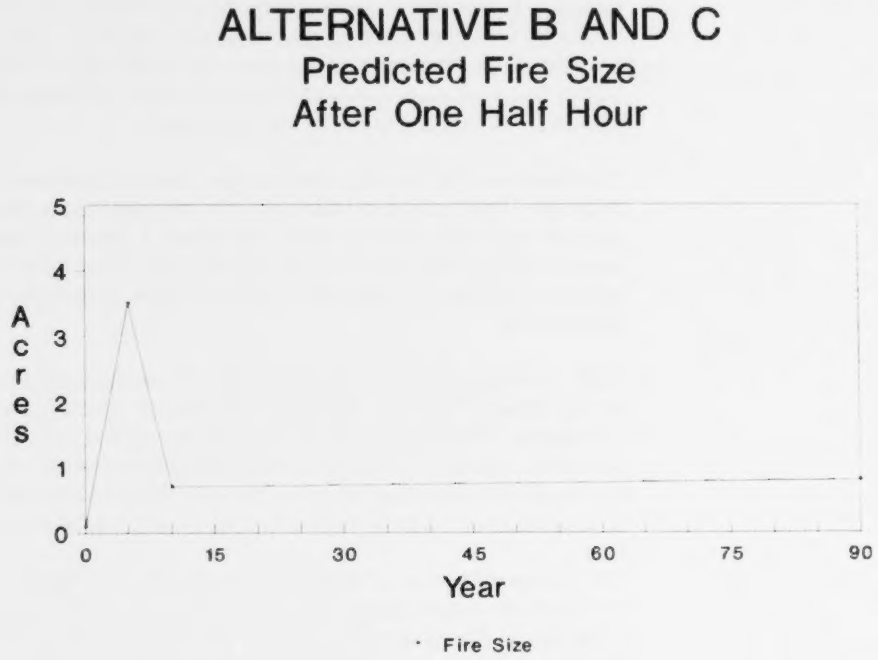


Figure IV-41 Predicted fire size after one-half hour, Alternatives B and C

ALTERNATIVE C

As in Alternative B, intensive timber recovery would significantly affect fuels in the area. The wildfire hazard would be extreme in the year following harvest and prior to fuel treatment.

Fuel reduction for harvest units ranges from no treatment to complete treatment. Predicted fuel treatments for this alternative include hand piling (69 acres, 2 percent), and low-intensity prescribed burning (2,073 acres, 45 percent).

Fuels on most partial cut areas would not be treated in order to enhance on-site productivity, wildlife habitat, and hillside and stream-channel erosion resistance. Continuous fuels not treated in clearcut areas could still constitute a significant localized fuel hazard. This hazard would remain at a high level for about 5 years then decline, over time, persisting at a low level for 2 decades.

The probability or risk of a fire occurring in an untreated area would be 6.8 percent per year, with an extent similar to what was presented in Alternative B. An increase in the number of snags being left under this alternative could increase the number of lightening-caused ignitions and suppression difficulties.

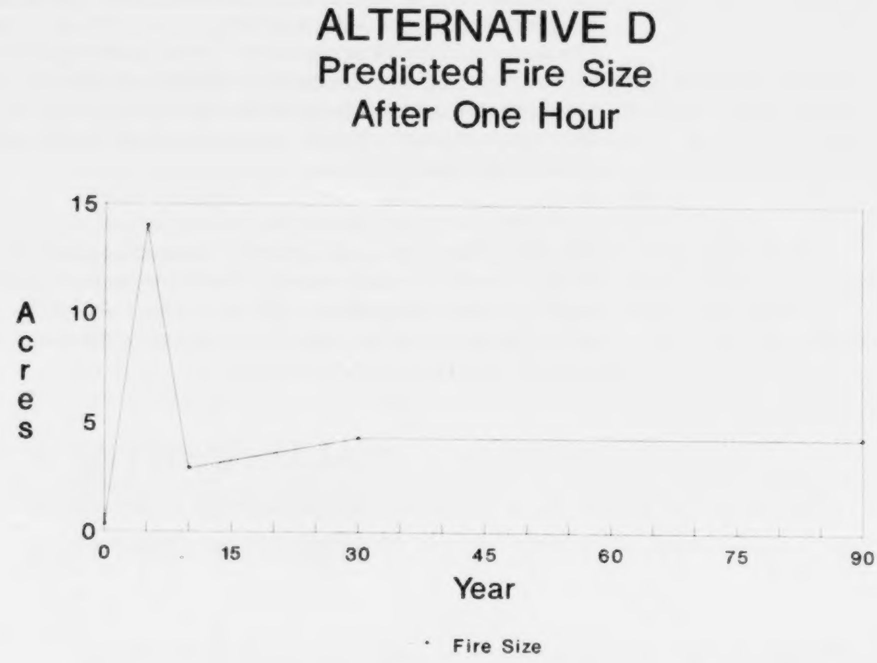
ALTERNATIVE D

Intensive timber recovery would significantly affect fuels in the area. Change would be brought about by timber harvest residues. Ground fuel loadings are directly related to harvest volume per acre, higher volumes generate higher fuel loadings. The wildfire hazard would be extreme in the year following harvest and prior to fuel treatment.

Fuel treatment for harvest units ranges from no treatment to complete treatment. Predicted fuel treatments for this alternative based on total harvest area include hand piling (43 acres, 1 percent), and low-intensity prescribed burning (2,247 acres, 48 percent). Completion of these activities would be needed to adequately protect forest resources and plantation investments.

Fuels on most partial cut areas would not be treated in order to enhance on site-organic material, wildlife habitat, hillside and stream-channel erosion resistance. Continuous fuels in clearcut areas that are not treated (668 acres) for maintenance of other resource values would still constitute a significant localized fuel hazard. This hazard would remain at a high level for 5 years then decline, over time, but would persist for 2 decades.

The increase in acres of helicopter logging would result in higher average fuel loadings. Initial attack time would increase as fewer roads would be constructed. The probability, or risk, of a fire occurring in an untreated area would be about 6.5 percent per year, with a potential extent of 60 acres per occurrence. Fire size would be 14 acres within 1 hour due to fewer roads providing access to the area which would extend initial attack time (see Figure IV-42). Fire intensities would be high, causing significant crowning and spotting activity. Hand crews would not be able to directly attack the fire. Snag densities would be similar to Alternative C, therefore lightening-caused ignitions and suppression difficulties would be similar. Fires occurring within untreated fuels would burn intensely and have an increased impact on vegetation and soil.



No New Roads, Attack Time • One Hour

Figure IV-42 Predicted fire size after one hour, Alternative D

ALTERNATIVE F

In addition to the moderate amount of short-term hazard presented by the moderate amount of salvage harvest proposed in this alternative, there would also be a high future risk of severe wild fire. This is due to the retention of about 3,000 acres of killed timber which would gradually deteriorate to high fuel-loading levels. Also, the increase in snag densities and their distribution could increase lightening ignition potential and suppression difficulties over Alternative D conditions.

Fuel treatment for harvest units ranges from no treatment to complete treatment. Predicted fuel treatments for this alternative include hand piling (36 acres, 1 percent), and low-intensity prescribed burning (1,406 acres, 55 percent). Completion of these activities would be needed to adequately protect forest resources and provide adequate site preparation for planting.

Fuels on most partial cut areas would not be treated in order to enhance on-site organic material, wildlife habitat, and hillside and stream-channel erosion resistance. The low levels of continuous fuels in clearcuts that are not treated (448 acres) for maintenance of other resource values would still constitute a significant localized fuel hazard. This hazard would remain at a high level for 5 years then decline, over time, but would persist for 2 decades.

The probability, or risk, of a fire occurring in an untreated area would be 6.4 percent per year, with a potential size of 60 acres per occurrence. Fire size could be 14 acres within 1 hour (see Figure IV-43) and fire-line intensities would be high, causing significant crowning and spotting activity, hand crews would not be able to directly attack the fire. The high density of snags in adjacent stands would contribute to this relatively extreme potential fire behavior.

Over time, the unharvested dead timber would increase fuel loadings, increasing the potential for wildfires of increasing size and severity. Potential fire size would increase sharply after harvest, then decline after fuels treatment (see Figure IV-43). This would be followed by a gradual increase in the risk of larger fires as aerial fuels fall to the forest floor on 3,066 acres of unharvested, dead timber.

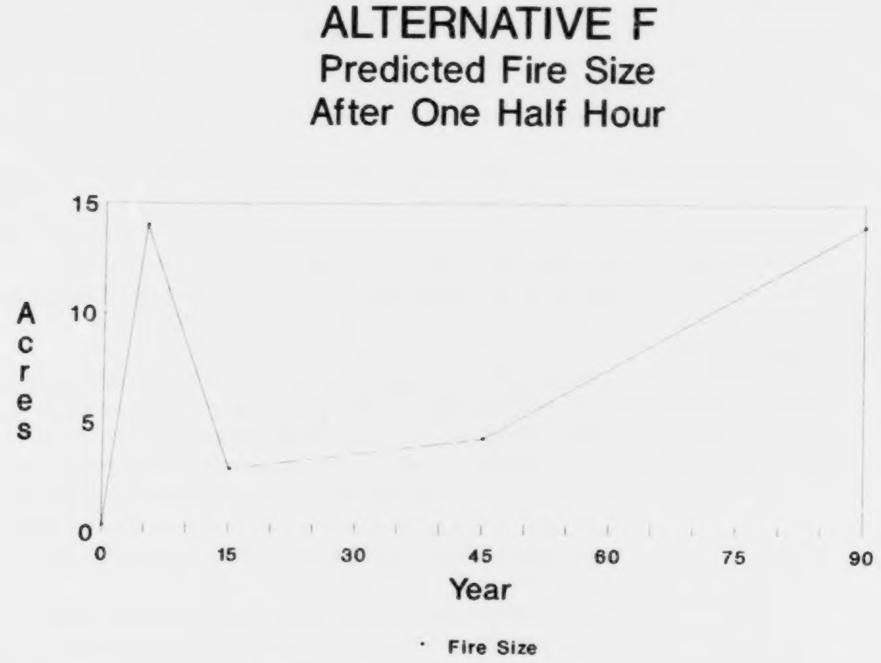


Figure IV-43 Predicted fire size after one-half hour, Alternative F

WILDLIFE

INTRODUCTION

The Shady Beach fire has changed most of the wildlife habitat characteristics within the fire boundary. Changes in habitat generally affect some species positively, others negatively, and sometimes have both positive and negative affects on the same species. Harvesting timber could further influence habitat changes.

Loss of decayed snags and logs, loss of protective hiding and thermal cover, and increased sediment and water temperature are common changes which negatively affect species such as small mammals, salamanders, cavity-nesting birds, deer, elk, and trout. Re-establishing early successional plant communities is a common change that positively affects species such as mountain quail, badger, song sparrow, deer, and elk.

This section presents concepts on how big-game, old-growth, interior-species, dead and defective, and riparian-dependent-species habitats were analyzed. The effects common to all alternatives are presented, followed by the specific wildlife effects for each alternative.

Big-Game Habitat

The effects on big-game habitat were measured using both forage/cover ratios and an overall habitat model.

Deer and elk are affected by habitat changes. Losses of hiding and thermal cover increase stress and energy expenditure and may affect productivity and mortality in populations. Fire increases early successional plant communities and thus increases forage.

Thermal cover is presently the most limiting big-game habitat component within the fire area. Thermal cover is defined as a forest stand that is at least 40 feet in height with at least 70 percent tree canopy cover. For natural forest stands within the analysis area, it is assumed that a 40-foot height for thermal cover is attained in 50 years. It is preferable for 50 percent of the thermal cover to be a forest stand with a multi-layered canopy which can intercept and hold snow, over 120 years old, and distributed in the lower elevation of the winter range.

Past management activities, fire history, and site productivity affect the amount and quality of big-game habitat available within the project area. The Shady Beach fire reduced the amount and quality of hiding and thermal cover and generally increased the amount and quality of forage in the area. However, forage-area size and spatial arrangement with available cover habitat generally compromised the forage habitat effectiveness. Lack of cover in the burned-over areas and excessive distances to reach cover from foraging areas would limit the degree to which big-game animals would use the habitat.

The capability of an area to provide usable habitat for big-game animals over time requires a continual flow of habitat suitable for foraging, for hiding cover, and for thermal cover. All three of these habitat types must be available throughout the rotation if big-game populations are to be maintained over time. These habitat types must be arranged in such a way that forage and cover are readily available, that they are utilizable, and that there are not excessive distances to reach one habitat type from another.

While forage/cover ratios provide good indications of big-game habitat conditions, they are not necessarily an indication of habitat quality. A habitat quality index (HQI) was used in this analysis as adapted from the interagency model, "A Model to Evaluate Elk Habitat in Western Oregon", compiled by the Forest Service in cooperation with the Bureau of Land Management and the Oregon Department of Fish and Wildlife (Wisdom 1986). Minor revisions in the model were made to address anticipated changes in forage and cover effectiveness based on information from the Silver Fire Recovery Project (USDA Forest Service 1988a) and from Harshman's Habitat Productivity Index (1979).

The habitat quality index (HQI) is derived by combining index values for both forage and cover size and spacing, forage value, cover value, and road density. Any habitat variable index value that is at 0.25 or less should be viewed as an indication that habitat viability is at or approaching non-viability.

The HQI can be used to provide a relative comparison of the capability of an area to provide high-quality habitat for big-game animals under average climatic conditions. These comparisons can be made between different subwatersheds during one time period, or they can be made between different time periods within a subwatershed.

HQI values can range between 0 and 1.0, with 1.0 being the highest possible effectiveness (optimal) for maximizing big-game production. HQI values between 0.600 and 0.999 indicate high-quality habitat conditions, values of 0.400 to 0.599 indicate viable conditions, 0.200 to 0.399 marginal conditions, and 0.199 or less indicate that the habitat is possibly nonviable for big-game production.

During severe winter weather conditions, subwatersheds with relatively low cover-size and spacing values may provide better protection from winter stress than areas with high cover-size and spacing values. This will be true in areas where the cover blocks involved are composed primarily of mature or old-growth timber which will provide effective thermal moderation, snow-holding capacity, and alternative forage resources through lichen and litterfall. In areas where the majority of the cover available is comprised of hiding cover, rather than thermal cover or optimal thermal cover, there is little or no resiliency to severe winter conditions due to ineffective thermal moderation, snow-holding capacity, and limited-forage availability.

For a complete display, by alternative, of the indices used to develop HQI, see Appendix D, Wildlife: Big-game habitat quality index.

Old-Growth Habitat

Old-growth forest stands are described under the Vegetation section of this Chapter as well as in Chapter III. Chapter II displays the number of old-growth acres as well as the number of acres of suitable habitat for northern spotted owl, pileated woodpeckers, and pine martens remaining under each alternative (see Figure II-1).

Old-growth habitat is a functional ecosystem capable of providing habitat needs for a variety of old-growth-dependent species. Old-growth-dependent species are those species which prefer old-growth habitat for survival or for reproduction.

The northern spotted owl is an indicator species for old-growth habitat and is also designated by the U.S. Forest Service to be a sensitive species. Discussion pertaining to the spotted owl can be found under the threatened, endangered and sensitive species section of this document.

Interior Forest Species Habitat

Interior species are plants and animals that evolved to require the combination of habitat characteristics found only within the interior of a large block of forest habitat. Toward the edge of the forest stand, as with adjoining large meadow or timber harvest area, the forest habitat is changed by influences from the adjoining areas. This edge effect extends into the forest an uncertain distance; the best information suggests 200 meters (Spies 1988). Farther into the interior of the forest, the habitat remains unaffected, or less affected, by influences of the forest edge. To maintain populations of interior species, the unaffected interior habitat needs to be large enough to contain all the habitat components typically provided by interior forests. To be self-sustaining, this habitat needs to be connected with other habitat blocks by corridors of similar habitat.

The interior species versus edge effect concept has not been studied in depth within the Douglas-fir zone of the Pacific Northwest. Consequently, adequate data is not available to draw strong conclusions on the consequences of fragmenting large blocks of Douglas-fir forest habitat. Neither have interior dependent species been fully identified nor have management guidelines been developed. From literature that presents studies and ideas relating to this concept (Forman 1986; Soule 1986) and discussions with Dr. Tom Spies, Pacific Northwest Region Research Forester, it is assumed that this concept would be applicable to this Region.

An interior habitat index (IHI) was developed to provide a relative measure of habitat suitable for interior forest species (species that select for or depend upon interior forest conditions for survival and/or reproduction).

This index also provides an opportunity to evaluate the relative potential to provide functional blocks of mature or interior forest conditions for purposes not directly related to wildlife or plant habitat (spiritual, aesthetic, and recreational values, etc.).

Five major habitat variables were selected to represent interior forest habitat quality; ACRE (habitat patch size), E/A (edge-to-area ratio), AGE (dominant stand age, CANOPY (degree of canopy diversity), and LWD (amount of large woody debris). Each of the five habitat variables is represented by an index value between 0.10 and 1.0, with 1.0 being the highest possible value. The five habitat variable indices are then used to derive an interior habitat index (IHI), which is the geometric mean of the five habitat variable indices.

The higher the IHI value, the greater the value of a particular piece of habitat for meeting the needs of a larger diversity of interior dependent species. The importance of one or more of the habitat variables may be highlighted for certain uses. AGE and LWD indices may be more critical for some specific uses (old-growth values) or for species that require structural habitat components that develop only in old-growth stands (large diameter trees with broken tops, large diameter snags, platform branches, heart-rot cavities, fractured bark, etc.). For species that require large territory sizes, ACRE indices may be critical. For species that rely on dense visual cover, CANOPY indices may be very important. E/A indices would be important for species or uses that are negatively affected by the presence of openings near or within the habitat block.

For a complete display of the variables by alternative, see the interior habitat index paper in Appendix E, Wildlife.

Dead and Defective Tree Habitat

Dead and defective tree habitat includes standing dead trees (snags), standing live defective trees, dead and down trees (logs), and whips (small, standing live or dead trees that remain standing after timber-harvest operations). Forest Service Region 6 policy (USDA Forest Service Manual R-6 Supplement 45 1988h) states that dead and defective tree habitat will be managed to maintain effective populations of primary cavity excavators in excess of 40 percent of their potential population capacity on Suitable Forest Lands (SFL). (See Glossary for definition.) The potential population capacity for natural timber stand conditions is 3.8 snags per acre. Forty percent capacity would mean 1.55 snags per acre (average). The effects of each alternative are displayed in percent of potential population capacity in each subwatershed. These percentages are compiled from past management acres without retained habitat, the proposed harvest acres which are to have 40 percent retained habitat, and remaining unmanaged, green timber with 100 percent habitat.

Primary cavity excavators are the various woodpeckers, which have the ability to excavate nesting cavities in dead and defective trees with heart-rot. Secondary cavity users are other animals, such as screech owls, bluebirds, and squirrels, which use these cavities in the following years or seasons for nesting and winter shelter. Deteriorating logs on the forest floor are burrowed under and into and used as nesting sites and shelter by various small mammals, amphibians, and reptiles.

Riparian-Dependent Species

Riparian-dependent species include an array of species groups with different habitat needs, such as aquatic insects, small mammals, and amphibians. Aquatic insects provide food for many larger species. They are restricted to the water most of their lives and are heavily influenced by solar heating, sediment, woody debris, and organic litterfall. The same conditions affect amphibians (such as tailed frogs and Olympic salamanders) that depend on cool, clear water for reproduction and survival. Small mammal diversity and density are greatest within riparian areas due to greater habitat diversity. Not all of the specific habitat requirements (such as size of forage habitat) are known for many riparian-dependent species that forage out and away from the main water bodies.

Streamside management units (SMUs) are often designed to provide vegetative buffers along bodies of water. These buffers are intended to protect water quality, principally for sediment and water temperature. However, stream buffer widths that are designed to protect water quality may not be adequate to fully meet the needs of all riparian species. The loss of foraging habitat and the loss of riparian micro-climate due to narrow buffer widths or reduced canopy closure will reduce the habitat necessary to maintain species diversity and self-sustaining population densities. Optimum or minimum streamside leave-strip sizes that are self-maintaining for providing habitat for both resident and transient wildlife remain to be determined (Cross 1985). However, Cross did find in his study of riparian leave-strips (averaging 221 feet in width) that most of the riparian small mammals appeared to maintain their species composition and abundance.

EFFECTS COMMON TO ALL ALTERNATIVES

Bird Habitat

Two osprey nest trees would be protected by a 660-foot buffer where timber harvest activities would not be allowed from March 1 to August 31.

Migratory waterfowl would not be affected by any of the alternatives as they are not commonly found within the project area. Populations of resident waterfowl that are cavity nesters (wood ducks, mergansers, and harlequin ducks) may be affected by the amount of dead and defective trees retained within one-quarter mile of the Hills Creek Reservoir, Hills Creek, and ponds (see section on dead and defective tree habitat in this Chapter).

Dead and Defective Tree Habitat

The loss of deteriorated snags and logs due to fire and suppression activities will result in a lack of suitable snags for about 5 years and a lack of suitable logs for an estimated 15 to 20 years. The 5-year time lag applies to the burn area and is applicable to each alternative. The snags created by the fire will require about 5 years to deteriorate from Stage 1 decay to Stage 2 decay, at which point the snags with heart-rot become suitable for woodpeckers to excavate nesting cavities (See Figure IV-44 and Figure

IV-45). Those trees which had no defect when they were killed will deteriorate from the outside and serve mostly as feeding trees for woodpeckers.

The 15-to-20-year time lag to obtain suitable logs also applies to the burn area and is applicable to each alternative. An inventory has not been made to determine the number of down logs remaining after the fire. From cursory observations, the abundance of Class 1 logs (see Figure IV-46) is equal to or greater than pre-fire numbers. This abundance of logs is made up of pre-fire Class 1 logs which survived the fire and the number of sound and defective trees that fell during the fire and suppression activities.

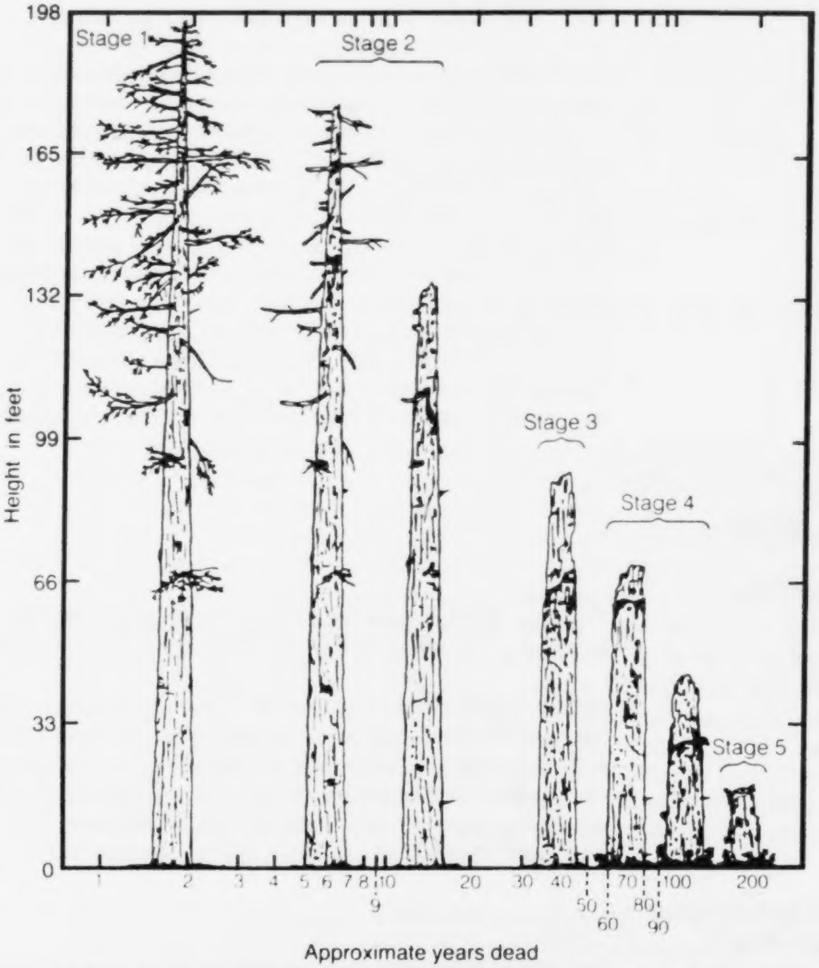


Figure IV-44 Five stages of deterioration of Douglas-fir snags (adapted from Cline et al. 1980)

SNAG DIAMETERS AND DECAY STAGES MOST OFTEN USED FOR CAVITY NESTING BY WOODPECKERS

Species	Snag diameter with bark (d.b.h., inches)	Snag decay stages*	
		Hard 2-3	Soft 4-5**
Lewis' woodpecker	17+		X
Acorn woodpecker	17+	X	
Red-breasted sapsucker	15+	X	
Williamson's sapsucker	17+	X	
Downy woodpecker	11+		X
Hairy woodpecker	15+		***X
White-headed woodpecker	15+		X
Three-toed woodpecker	17+	X	
Black-backed woodpecker	17+	X	
Northern flicker	17+		X
Pileated woodpecker	25+	****X	

Sources: Mannan et al. (1980). Raphael and White (1984). Zarnowitz and Manuwal 1985.

*Decay stages after Cline et al. (1980).

**Stage 5 snags, except those with a hard outer casing, are too far decomposed to be used for nesting by most primary excavators.

***May also use decay stages 2-3.

****Will also use hard snags of decay stage 1.

Figure IV-45 Snag diameters and decay stages

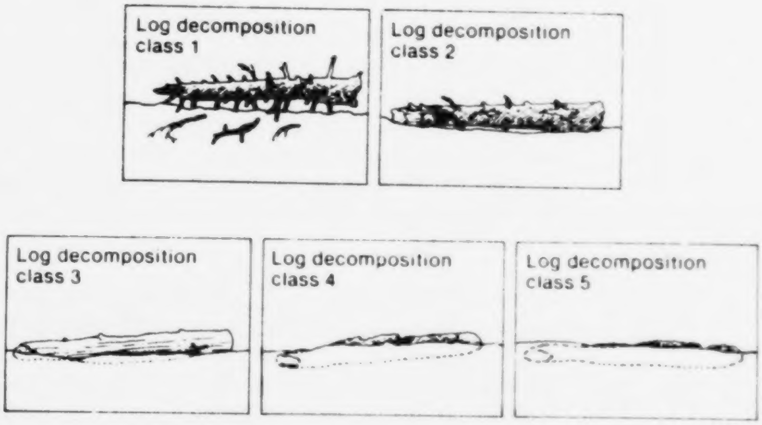

Log decomposition class 1
Log decomposition class 2
Log decomposition class 3
Log decomposition class 4
Log decomposition class 5

Figure IV-46 When they fall, trees and snags immediately enter one of five log decomposition classes (reduced from Maser et. al. 1979, fig. 44, p. 80)

Riparian-Dependent Species

The loss of riparian shade and concealment cover would exist for about 3 years. At this time grass, brush, and riparian hardwood trees would offer concealment cover for foraging and begin to offer some shade for moderating water temperatures in the smaller streams that sustained moderate-to-intense burns. This recovery would be beneficial to a few riparian species with tolerance for open and drier micro-climates. About 120 to 200 years would be required before full structural diversity of the riparian habitat is regained in intensively burned areas. In light to moderately burned areas, recovery would be more rapid where buffers are maintained.

Logs would deteriorate in about 15 to 20 years to offer suitable habitat for some amphibians such as clouded salamanders and small mammals. High riparian species diversity could be expected in 50 years as the forest canopy closes and provides a cool, moist summer micro-climate in the riparian areas. However, winter temperature moderation and large woody debris may be limited for about 120 to 200 years, when maximum riparian species diversity could be expected.

Threatened, Endangered and Sensitive Species

In accordance with the Hills Creek bald eagle management plan (USDA Forest Service 1983), the designated bald eagle management area (BEMA) in Bull Creek would not be considered for timber salvage or other related activities in any alternative. For this reason, there would be no effects on the BEMA from any alternative.

The Bull Creek SOHA would not be included as part of the Regional SOHA network under any of the alternatives. Only 971 acres of this SOHA are considered to still offer suitable spotted owl habitat. The fire rendered 529 acres of the 1,500 acre SOHA unsuitable as habitat. This 529 acres is classified as unsuitable because the multi-layered canopy has been reduced or eliminated and the canopy closure is less than 70 percent (USDA Forest Service 1988f). Since this SOHA no longer contains enough acres of suitable habitat to comply with Regional direction for inclusion in the Regional SOHA network, a new area would have to be selected to comply with Regional guidelines. This selection will involve changing land allocation decisions and will be made in the Final Environmental Impact Statement for the Willamette National Forest Land and Resource Management Plan. Minimum spotted owl needs would be met by network SOHAs outside the recovery area.

There are small amounts of cliff habitat that have the potential to provide nesting ledges for peregrine falcons, a Federally listed species. Numerous small ponds within the fire area were field checked and determined to be unlikely as habitat for the spotted frog, Oregon chub and western pond turtle which are listed as sensitive by the U.S. Forest Service. Another sensitive species, the one-spot rhyacophilan caddisfly, is known to inhabit a high elevation tributary to Hills Creek about eight miles from the analysis area. Whether this caddisfly occurs in the analysis area is unknown at this time.

ALTERNATIVE E
NO ACTION

Changes in wildlife habitat produced by the fire would not be altered by this alternative. The natural succession of vegetative habitat would determine habitat conditions and wildlife populations.

Big-Game Habitat

Alternative E would maintain the existing situation and permit natural vegetation succession. The forage/cover ratios and HQI for each subwatershed and winter range is presented in Figure IV-47. The current (Year 0) HQI for the overall analysis area is 0.61, indicating highly viable habitat conditions for big-game populations. Subwatersheds within the analysis area range from 0.504 (viable) in Tufti to 0.659 (highly viable) in Landes. Habitat quality was reduced in some subwatersheds due to large forage areas. Habitat quality was increased in some subwatersheds because spot fires created small forage areas among large cover blocks, forage was re-established, and because forage quality was increased through emergency fire rehabilitation seeding and fertilizing.

ALTERNATIVE E - NO ACTION
BIG-GAME FORAGE/COVER RATIOS
BY SUBWATERSHEDS AND WINTER RANGES
FOR YEAR 0

Winter Range North of Hills Creek

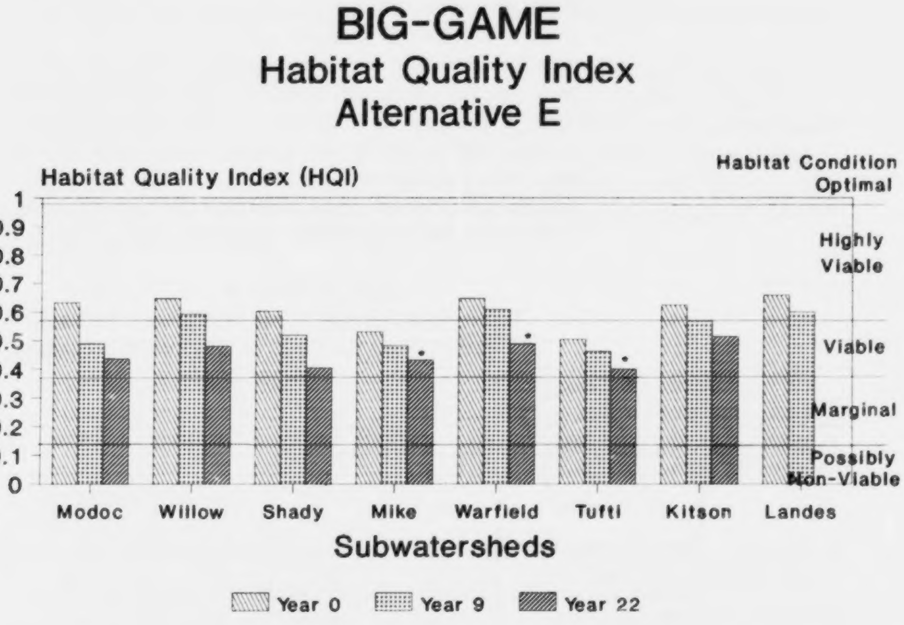
Subwatershed	Forage	Hiding Cover	Thermal Cover	Habitat Quality Index	Habitat Condition
22B Shady Gate	54%	8%	38%	.602	Highly Viable
22C Mike	62%	12%	26%	.530	Viable
22D Warfield	30%	15%	54%	.646	Highly Viable

Winter Range South of Hills Creek

21A Modoc	37%	10%	53%	.633	Highly Viable
21B Willow	25%	36%	39%	.646	Highly Viable
22Q Kitson	56%	7%	37%	.624	Highly Viable
22P Tufti	83%	7%	10%	.504	Viable
22R Landes	39%	21%	40%	.659	Highly Viable

Figure IV-47 Big-game forage/cover ratios and HQI, Alternative E

The fire resulted in an abundance of forage which is expected to initially help increase big-game populations. However, without vegetation manipulation to provide forage in later years, the elk and deer populations would decline. By Year 22, the HQI for the analysis area would drop to 0.39, marginal viability for big-game populations. Figure IV-48 shows the decline in habitat viability for subwatersheds in the analysis area. This trend results from young conifers gradually shading out forage plants and changing the areas from forage to hiding cover. Landes is the only drainage that would become nonviable at Year 22 due to low forage value.



• Size & spacing, forage and/or cover values <.25 indicate a possibly non-viable habitat condition, despite HQI

Figure IV-48 Big-game habitat quality index (HQI), Alternative E

Alternative E has a forage/hiding/thermal cover value of 59 percent/11 percent/30 percent. This alternative would preserve the limited thermal cover that survived the fire and help sustain big-game populations through severe winter conditions in the short-term. It would also help provide for long-term forage needs, because maintaining blocks of green timber now would allow for future options to manipulate forage/cover ratios. This would provide future opportunities to either harvest some timber to create forage or maintain timber stands for thermal cover. While this may not prevent the expected population decline, some options would be preserved to help soften it.

Old-Growth Habitat

This alternative would designate 300 acres of pileated woodpecker habitat and 160 acres of pine marten habitat. The following sections on interior species habitat and threatened, endangered, and sensitive species provide further indicators of old-growth habitat under this alternative.

Interior Forest Species Habitat

Interior species habitat would not be reduced under this alternative, maintaining the 5,701 habitat acres left after the fire. The total overall IHI would be 0.41, in 16 habitat patches. Critical connective habitat corridors would be maintained.

Dead and Defective Tree Habitat

Dead and defective tree habitat would be maintained to provide 69.2 percent population capacity for primary cavity excavator species today (Year 0), declining to 52.9 percent in 30 years. There would be a deficit in hard snags in the fire area that would last about 5 years until the recently killed trees deteriorate to a Stage 2 condition. The burned area would be lacking soft snag habitat for about 30 years.

Riparian-Dependent Species

Nine percent (256 acres) of the available riparian habitat was impacted where multi-storied stands were damaged or destroyed by fire. No additional impacts are expected under this alternative.

Threatened, Endangered and Sensitive Species

Habitat would not be managed for the northern spotted owl under this alternative.

ALTERNATIVE B

Big-Game Habitat

Alternative B has a forage/hiding/thermal cover of 74 percent/9 percent/17 percent. Initially 74 percent of the area becomes forage, with hiding and thermal cover on 9 and 17 percent of the area respectively. The forage/hiding/thermal cover ratios and HQI for each subwatershed and winter range is presented in Figure IV-49.

ALTERNATIVE B
BIG-GAME FORAGE/COVER RATIOS
BY SUBWATERSHEDS AND WINTER RANGES
FOR YEAR 0

Winter Range North of Hills Creek

Subwatershed	Forage	Hiding Cover	Thermal Cover	Habitat Quality Index	Habitat Condition
22B Shady Gate	80%	8%	12%	.509	Viable
22C Mike	79%	9%	12%	.476	Viable
22 D Warfield	30%	15%	54%	.645	Highly Viable

Winter Range South of Hills Creek

21A Modoc	81%	5%	14%	.635	Highly Viable
21B Willow	25%	36%	39%	.644	Highly Viable
22Q Kitson	68%	7%	25%	.579	Viable
22P Tufti	92%	1%	7%	.369	Possibly Nonviable*
22R Landes	53%	22%	25%	.604	Highly Viable

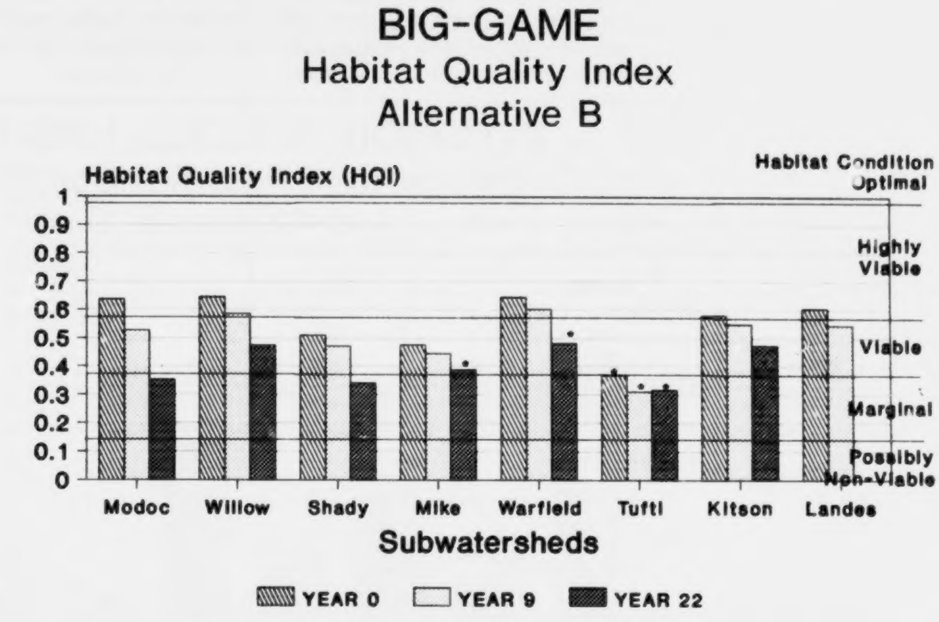
*Possibly nonviable due to a cover value index <.25 (.17).

Figure IV-49 Big-game forage/cover ratios and HQI, Alternative B

The initial HQIs indicate habitat conditions for nonviable to highly viable big-game populations. This alternative would not preserve all the thermal cover that survived the fire. With timber harvest in low-elevation winter range (subwatersheds Modoc, Shady, and Mike), this could be detrimental for sustaining big-game populations through severe winters immediately and in the long-term, and it could lead to a forage deficit in the long-term.

The fire resulted in an abundance of forage which is expected to help initially increase the big-game populations. Additional forage would be created through regeneration harvests under this alternative. Figure IV-50 shows that the initial increases in habitat quality would be affected by habitat quality degradation between Years 9 and 22. Mike, Warfield, Tufti, and Landes subwatersheds would all have nonviable habitat conditions by Year 22 due primarily to low forage, cover, and size and spacing values. Tufti subwatershed would have nonviable habitat throughout the next 2 decades due to low cover values.

The elk and deer populations would decline when forage grows into hiding cover in about 20 years. This alternative would not save future options to both create adequate forage through timber harvest and/or maintain the remaining optimal thermal cover.



• Size & spacing, forage and/or cover values <.25 indicate a possibly non-viable habitat condition, despite HQI

Figure IV-50 Big-game habitat quality index (HQI), Alternative B

Bird Habitat

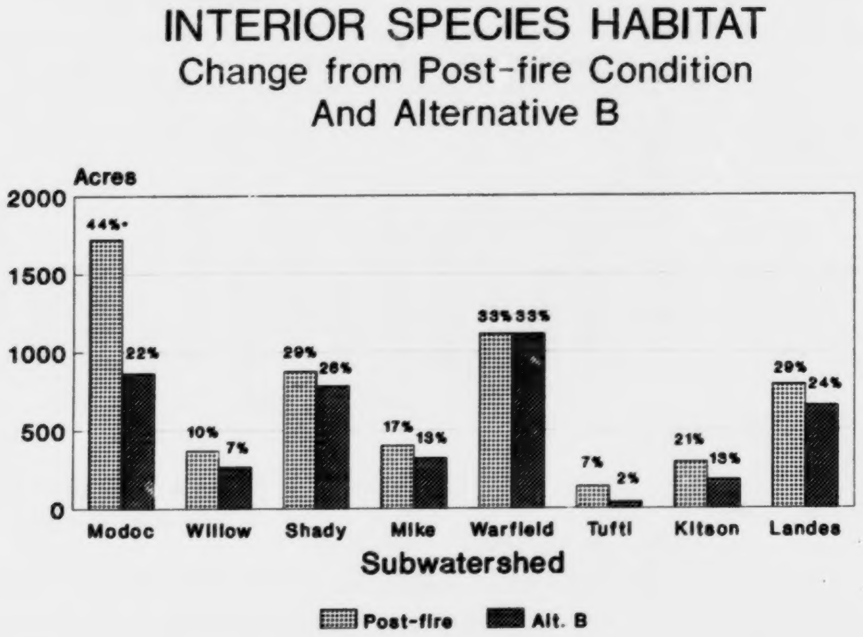
Blue Grouse would be negatively affected by loss of 1,199 acres of forested habitat due to clearcut timber harvesting. The same 1,199 acres would enhance the quail habitat. Alternative B would enhance the northern barred owls habitat by creating more open forage areas and forest edge.

Old-Growth Habitat

This alternative would not designate suitable habitat acres for the pileated woodpecker or pine marten. The following sections on interior species habitat and threatened, endangered, and sensitive species provide further indicators of old-growth habitat under this alternative.

Interior Forest Species Habitat

Alternative B would result in a 1,479-acre reduction of remaining suitable interior habitat, leaving 4,222 acres classified as suitable habitat, with an overall IHI of 0.40 in 13 habitat patches. This IHI value represents a weighted average of the IHI values for each of the habitat patches remaining and does not reflect the magnitude of the impacts to each subwatershed and critical interior species habitat. Figure IV-51 displays the acreage changes in remaining suitable habitat, as well as the remaining suitable habitat as percent of total subwatershed acres for each affected subwatershed. One habitat patch within the critical connective corridor along Hills Creek would no longer meet minimum standards for interior habitat (size and spacing, and edge-to-area ratio). One habitat patch would become marginal in viability due to edge-to-area ratio. Connective habitat outside of this critical corridor would also be impacted. Two other habitat patches would also fail to meet minimum standards.



* percent of each total subwatershed acres

Figure IV-51 Interior species habitat, Alternative B

Dead and Defective Tree Habitat

By leaving an average of 0.8 snags per acre, dead and defective tree habitat would be maintained to provide 46.2 percent population capacity for primary cavity excavator species today (Year 0), declining to 39.6 percent in 30 years. Alternative B would not provide for green replacement trees to maintain the snag habitat throughout the timber harvest rotation. Figure IV-52 shows the cumulative percentage of potential population capacity of cavity nesters by subwatershed, including both the managed and unmanaged stands.

DEAD AND DEFECTIVE HABITAT - ALTERNATIVE B

Percentage of Potential Population Capacity for Primary Nesters

Subwatersheds Affected by Fire	Hard Snags 5-30 yrs	Hard Snags 31+ yrs*	Soft Snags 0-30 yrs**	Soft Snags 31+ yrs
21A Modoc	53.6%	44.5%	21.4%	53.6%
22B Shady Gate	53.2%	46.0%	26.3%	53.0%
22C Mike	33.3%	27.6%	26.3%	33.0%
22Q Kitson	55.9%	51.5%	42.5%	55.9%
22R Landes	45.0%	42.5%	39.3%	44.0%
22P Tufti	36.4%	25.7%	07.4%	36.4%

* The percentage decrease in the hard snags in the 31+ years column reflects those acres of total fire kill. When these fire-killed trees move from hard snags to soft snags, there will not be trees to replace the hard snags.

** The potential population capacity for soft snag cavity nesters based on the availability of soft snag habitat remaining in the unburned portions of the subwatersheds.

Figure IV-52 Dead and defective habitat, Alternative B

The snags left under Alternative B would provide hard snags until about 30 years, at which time these snags would have deteriorated to soft snag habitat. The percentage of hard snags drops at 30 years because replacement trees are not retained in regeneration harvest units. Percentages in Figure IV-50 shows hard snags at Year 31+ are supported by acres of unmanaged forest and acres of partial harvest.

Riparian-Dependent Species

Salvage activities would take place on 41 percent (1,038 acres) of the remaining riparian habitat within the project area. Decreases in habitat quality and usability for wildlife would be high since 75 percent of the timber volume in Classes I to III stream buffers and all of the timber volume in Class IV streams would be removed. This would result in high levels of habitat disturbance, increased recovery time, and a loss to both the multi-story attribute and the moist micro-climate of the riparian habitat.

Threatened, Endangered, and Sensitive Species

Habitat would not be designated for the northern spotted owl under this alternative. Future options to manage habitat in the analysis area for the northern spotted owl would be foregone under this alternative.

Big-Game Habitat

Alternative C has a forage/hiding/thermal cover of 72 percent/11 percent/17 percent. Initially 72 percent of the area becomes forage, with hiding and thermal cover 11 and 17 percent of the area, respectively. The forage/hiding/thermal cover ratios and HQI for each subwatershed and winter range is presented in Figure IV-53.

The initial HQIs indicate habitat conditions for nonviable to highly viable big-game populations. This alternative would not preserve all the thermal cover that survived the fire. With timber harvest in low-elevation winter range (subwatersheds Modoc, Shady, and Mike), this could be detrimental for sustaining big-game populations through severe winters immediately and in the long-term, and it could lead to a forage deficit in the long-term.

The fire resulted in an abundance of forage which is expected to help initially increase the big-game populations. Additional forage would be created through regeneration harvests under this alternative. Figure IV-54 shows that the initial increases in habitat quality would be affected by habitat quality degradation between Years 9 and 22. Mike, Warfield, Tufti, and Landes subwatersheds would all have nonviable habitat conditions in Year 22 due primarily to low forage, cover, and size and spacing values. Tufti subwatershed would have nonviable habitat throughout the next 2 decades due to low cover values.

The elk and deer populations would decline when forage grows into hiding cover in about 20 years. This alternative would not save future options to both create adequate forage through timber harvest and/or maintain the remaining optimal thermal cover.

ALTERNATIVE C
BIG-GAME FORAGE/COVER RATIOS
BY SUBWATERSHEDS AND WINTER RANGES
FOR YEAR 0

Winter Range North of Hills Creek

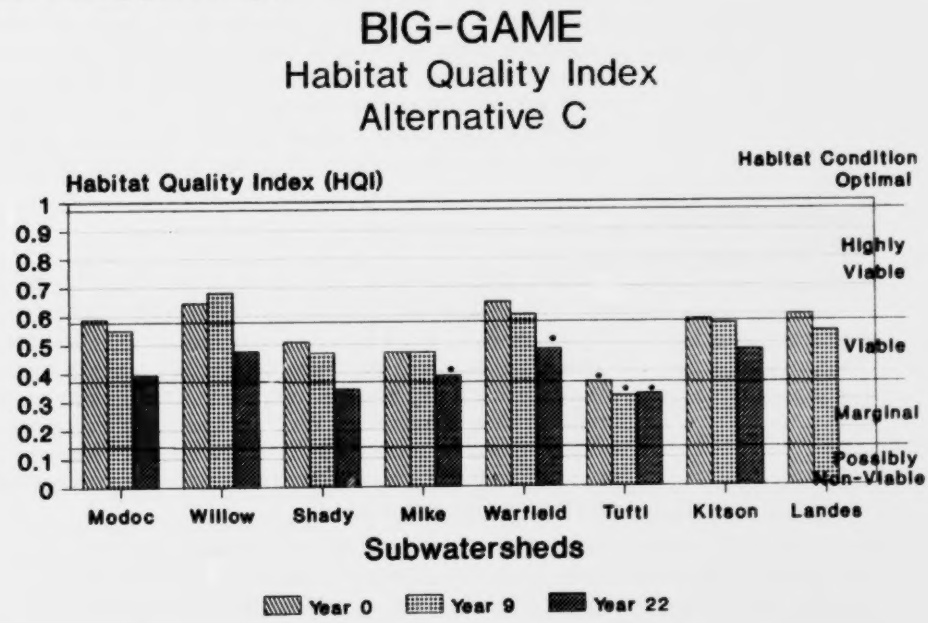
Subwatershed	Forage	Hiding Cover	Thermal Cover	Habitat Quality Index	Habitat Condition
22B Shady Gate	76%	10%	14%	.508	Viable
22C Mike	78%	10%	12%	.471	Viable
22 D Warfield	30%	15%	54%	.647	Highly Viable

Winter Range South of Hills Creek

21A Modoc	73%	8%	19%	.588	Viable
21B Willow	25%	36%	39%	.644	Highly Viable
22Q Kitson	69%	7%	24%	.584	Viable
22P Tufti	87%	5%	8%	.366	Possibly Nonviable*
22R Landes	50%	24%	26%	.597	Highly Viable

*Possibly nonviable due to a cover value index <.25 (.17).

Figure IV-53 Big-game forage/cover ratios and HQI, Alternative C



•Size & spacing, forage and/or cover values <.25 indicate a possibly non-viable habitat condition, despite HQI

Figure IV-54 Big-game habitat quality index (HQI), Alternative C

Bird Habitat

Blue Grouse would be negatively affected by loss of 744 acres of forested habitat due to regeneration harvest. The same 744 acres would enhance quail habitat. Habitat for the northern barred owls would be enhanced by creating more open foraging areas and forest edge.

Old-Growth Habitat

This alternative would designate 300 acres of pileated woodpecker habitat and 160 acres of pine marten habitat. The following sections on interior species habitat and threatened, endangered, and sensitive species provide further indicators of old-growth habitat under this alternative.

Interior Forest Species Habitat

Alternative C would have the same impacts as Alternative B, resulting in a 1,499-acre reduction of remaining suitable interior habitat. This alternative would also have the same effects on interior species habitat within the critical connective corridor along Hills Creek and the connective habitat outside of the critical corridor.

Dead and Defective Tree Habitat

Alternative C would provide for leaving 40 percent of potential population capacity of cavity nesters (average 1.55 trees/acre) in salvage harvest areas. In areas where green trees exist, an additional average of 1.8 trees/acre will be retained for green replacement trees which will die in about 30 years, thus maintaining the hard snag habitat for the next 60 years. For the entire analysis area, the combination of trees left in managed and unmanaged stands will provide for a total of 49.6 percent of potential population capacity of cavity nesters. Figure IV-55 shows the cumulative percentage of potential population capacity of cavity-nesters by subwatershed, including both the managed and unmanaged stands under this alternative. Alternative C would provide log-habitat prescription of 8 to 15 logs of 8 feet in length and 16 inches in diameter or larger.

Riparian-Dependent Species

Salvage activities would take place on less than 32 percent (820 acres) of the remaining riparian habitat within the project area. Since stream buffers (75-feet-wide on each side for Class I, II, and III streams) would be used, some impacts would be moderate. Yarding corridors would create limited disturbance along Class I, II, and III streams. Buffers would be retained on some Class IV streams. Width of these buffers would be variable and would depend on topography and site-specific features. The effects would be similar to those effects described under Alternative B except the impacts would occur on less area.

DEAD AND DEFECTIVE HABITAT - ALTERNATIVE C

Percentage of Potential Population Capacity for Primary Cavity Nesters

Subwatersheds Affected by Fire	Hard Snags 5-30 yrs	Hard Snags 31+ yrs*	Soft Snags 0-30 yrs**	Soft Snags 31+ yrs
21A Modoc	62.5%	58.3%	21.4%	62.5%
22B Shady Gate	60.3%	52.0%	26.3%	60.3%
22C Mike	38.6%	32.0%	26.3%	38.6%
22Q Kitson	60.1%	58.7%	42.5%	60.1%
22R Landes	47.1%	45.9%	39.3%	47.1%
22P Tufti	39.0%	28.7%	07.4%	28.7%

* The percentage decrease in the hard snags in the 31+ years column reflects those acres of total fire kill. When these fire-killed trees move from hard snags to soft snags, there will not be trees to replace the hard snags.

** The potential population capacity for soft snag cavity nesters based on the availability of soft snag habitat remaining in the unburned portions of the subwatersheds.

Figure IV-55 Dead and defective habitat, Alternative C

Threatened, Endangered, and Sensitive Species

Habitat would not be designated for the northern spotted owl under this alternative. Future options to manage habitat in the analysis area for the northern spotted owl would be foregone under this alternative.

ALTERNATIVE D

Big-Game Habitat

Alternative D has a forage/hiding/thermal cover ration of 62 percent/19 percent/19 percent. Initially 62 percent of the area becomes forage, with hiding and thermal cover each 19 percent of the analysis area. Alternative D would reduce the optimum thermal cover throughout the affected subwatersheds. This would happen as the thermal cover was converted to hiding cover through partial cutting timber stands. The forage/cover ratios and HQI for each subwatershed and winter range is presented in Figure IV-56.

The initial HQIs indicate habitat conditions for nonviable to highly viable big-game populations. This alternative would not preserve the limited thermal cover that survived the fire. Under the alternative, proposed timber harvest in low elevation winter range (subwatersheds Modoc, Shady, and Mike), would be detrimental for sustaining big-game populations through severe winters immediately and in the long-term and it would lead to forage deficit in the long-term. This effect is not due to removal of green timber as in Alternatives C and B, but is due to anticipated canopy damage associated with falling and yarding dead trees through the remaining green canopy.

ALTERNATIVE D
BIG-GAME FORAGE/COVER RATIOS
BY SUBWATERSHEDS AND WINTER RANGES
FOR YEAR 0

Winter Range North of Hills Creek

Subwatershed	Forage	Hiding Cover	Optimum Thermal	Habitat Quality Index	Habitat Condition
22B Shady Gate	69%	14%	17%	.539	Viable
22C Mike	73%	14%	13%	.490	Viable
22D Warfield	30%	15%	54%	.640	Highly Viable

Winter Range South of Hills Creek

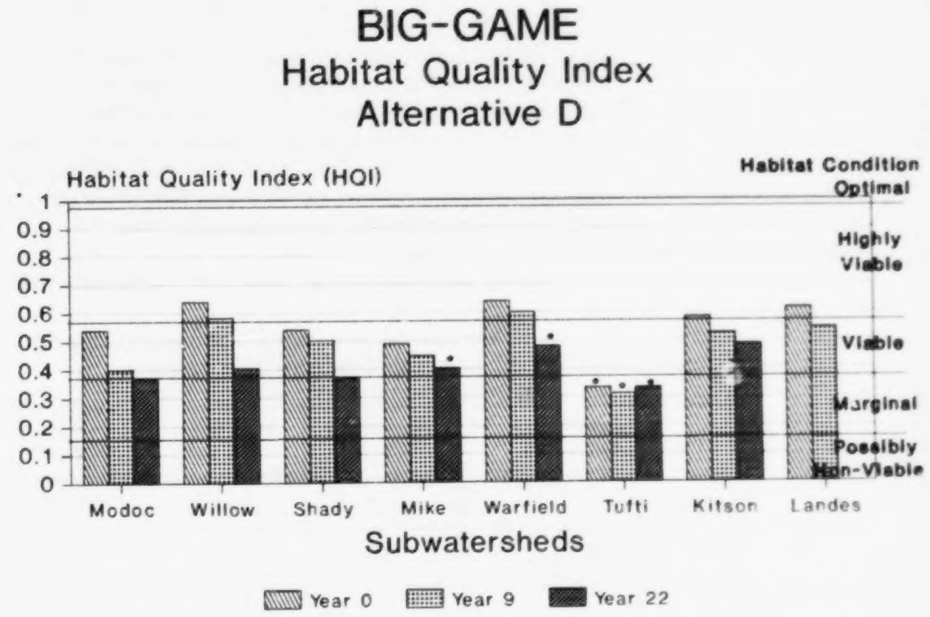
Subwatershed	Forage	Hiding Cover	Optimum Thermal	Habitat Quality Index	Habitat Condition
21A Modoc	55%	26%	19%	.540	Viable
21B Willow	25%	36%	39%	.639	Highly Viable
22Q Kitson	62%	13%	25%	.581	Viable
22P Tufti	73%	18%	9%	.333	Possibly Nonviable*
22R Landes	46%	25%	29%	.613	Highly Viable

*Possibly nonviable due to a cover value index <.25 (.13).

Figure IV-56 Big-game forage/cover ratios and HQI, Alternative D

The fire resulted in an abundance of forage which is expected to help initially increase the big-game populations. Figure IV-57 shows that the initial increases in habitat quality would be affected by rapid habitat quality degradation between Years 9 and 22. Mike, Warfield, Tufti, and Landes subwatersheds would all have nonviable habitat conditions by Year 22 due primarily to low forage, cover, and size and spacing values. Tufti subwatershed would have nonviable habitat throughout the next 2 decades due to low cover values.

The elk and deer populations would rapidly decline when this forage grows into hiding cover over the next 2 decades. Saving blocks of green timber now to harvest later would help maintain options for meeting the future need for big-game forage. This could help to soften the expected rapid population decline. This alternative would provide timber for future conversion to forage as the trees left in partial cut stands would be saved to harvest later.



• Size & spacing, forage and/or cover values <.25 indicate a possibly non-viable habitat condition, despite HQI

Figure IV-57 Big-game habitat quality index (HQI), Alternative D

Bird Habitat

Only acres of 80 to 100 percent timber stand mortality would be clearcut under this alternative. Blue grouse, quail, and northern barred owls would not be affected.

Old-Growth Habitat

This alternative would designate 300 acres of pileated woodpecker habitat and 160 acres of pine marten habitat. The following sections on interior species habitat and threatened, endangered, and sensitive species provide further indicators of old-growth habitat under this alternative.

Interior Forest Species Habitat

Alternative D would show a 1,450 acre reduction of remaining suitable interior habitat leaving 4,251 acres with an overall IHI of 0.40 in 13 habitat patches. The impacts would be the same as Alternative B as they would have the same effects on interior species habitat within the critical connective corridor along Hills Creek and the connective habitat outside of the critical corridor.

Dead and Defective Tree Habitat

Alternative D would provide the same mitigation for tree snag habitat and down log habitat as Alternative C. Dead and defective tree habitat would be maintained to provide 51.9 percent population capacity for primary cavity excavator species today (Year 0), declining to 46.2 percent in 30 years. Figure IV-58 shows the cumulative percentage of potential population capacity of cavity nesters by subwatershed, including both the managed and unmanaged stands under this alternative.

DEAD AND DEFECTIVE HABITAT - ALTERNATIVE D

Percentage of Potential Population Capacity
for Primary Cavity Nesters

Subwatersheds Affected by Fire	Hard Snags 5-30 yrs	Hard Snags 31+ yrs*	Soft Snags 0-30 yrs**	Soft Snags 31+ yrs
21A Modoc	60.5%	55.5%	21.4%	60.5%
22B Shady Gate	58.5%	50.2%	26.3%	58.5%
22C Mike	39.7%	34.0%	26.3%	39.7%
22Q Kitson	64.7%	64.0%	42.5%	64.7%
22R Landes	47.8%	46.5%	39.3%	47.8%
22P Tufti	40.2%	27.1%	07.4%	40.2%

* The percentage decrease in the hard snags in the 31+ years column reflects those acres of total fire kill. When these fire-killed trees move from hard snags to soft snags, there will not be trees to replace the hard snags.

** The potential population capacity for soft snag cavity excavators based on the availability of soft snag habitat remaining in the unburned portions of the subwatersheds.

Figure IV-58 Dead and defective habitat, Alternative D

Riparian-Dependent Species

Salvage activities would take place on 33 percent (840 acres) of the remaining riparian habitat within the project area. Since stream buffer prescriptions are the same as those for Alternative C, most impacts would be similar to those for Alternative C. The effects would be similar to those effects described under Alternative B except the impacts would occur on less area.

Threatened, Endangered, and Sensitive Species

Habitat for the northern spotted owl would not be designated under this alternative. By harvesting only dead trees, future options for managing spotted owl habitat would be retained. Recovery of the habitat suitability would require recruitment of dead and defective habitat and the re-establishment of the multi-layered canopy structure.

ALTERNATIVE F

Big-Game Habitat

Alternative F has a forage/hiding/thermal cover ratio of 62 percent/11 percent/27 percent. Initially 62 percent of the analysis area becomes forage with 11 and 27 percent of the area becoming hiding and thermal cover respectively. Alternative F would reduce the optimum thermal cover and increase the forage in portions of the subwatersheds. The forage/cover ratios and HQI for each subwatershed and winter range is presented in Figure IV-59.

ALTERNATIVE F
BIG-GAME FORAGE/COVER RATIOS
BY SUBWATERSHEDS AND WINTER RANGES
FOR YEAR O

Winter Range North of Hills Creek

Subwatershed	Forage	Hiding Cover	Thermal Cover	Habitat Quality index	Habitat Condition
22B Shady Gate	69%	6%	25%	.551	Viable
22C Mike	73%	10%	17%	.504	Viable
22D Warfield	30%	15%	54%	.646	Highly Viable

Winter Range South of Hills Creek

21A Modoc	56%	7%	37%	.630	Highly Viable
21B Willow	25%	36%	39%	.637	Highly Viable
22Q Kitson	62%	7%	31%	.589	Viable
22P Tufti	71%	20%	9%	.498	Viable
22R Landes	45%	19%	36%	.603	Highly Viable

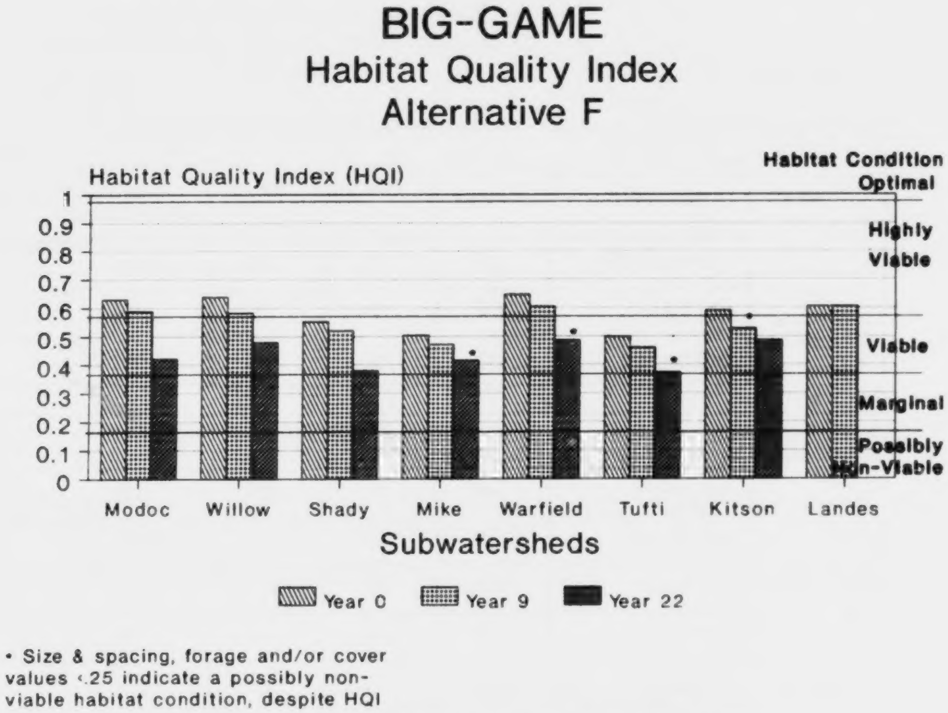
Figure IV-59 Big-game forage/cover ratios and HQI, Alternative F

The initial HQIs indicate habitat conditions for viable to highly viable big-game populations. Optimum thermal cover would be maintained in the low-elevation winter range. This would be critical habitat during severe winters. The fire resulted in an abundance of forage which is expected to initially help increase big-game populations. Figure IV-60 shows that the initial increases in habitat quality would be offset by a rapid degradation in habitat quality between Years 9 and 22. This trend would result from young conifers gradually shading out forage plants and changing the areas from forage to hiding cover. Mike, Warfield, Tufti, and Landes subwatersheds would be nonviable at Year 22 because of low forage, cover, and size and spacing values. Kitson subwatershed would have nonviable habitat in Year 9 due to low forage value.

This alternative would preserve the limited thermal cover that survived the fire and help provide for long-term forage needs; because maintaining blocks of green timber now would allow for future options to manipulate forage/cover ratios and HQI values. This would provide future opportunities to either harvest some timber to create forage, or maintain timber stands for thermal cover. While this may not prevent the expected population decline, some options would be preserved to help soften the impacts.

Bird Habitat

Only acres of 80 to 100 percent mortality would have regeneration harvest under this alternative. Blue Grouse, quail, and northern barred owls would not be affected.



• Size & spacing, forage and/or cover values <.25 indicate a possibly non-viable habitat condition, despite HQI

Figure IV-60 Big-game habitat quality index (HQI), Alternative F

Old-Growth Habitat

This alternative would provide one pileated woodpecker habitat area of 300 acres and three pine marten habitat areas of 160 acres each (480 acres) retained. The following sections on interior forest species habitat and threatened, endangered, and sensitive species provide further indicators of old-growth habitat under this alternative.

Interior Forest Species Habitat

Alternative F would result in only a 1 percent reduction of the remaining suitable interior habitat, retaining 5,660 acres. The total overall IHI would be 0.41 in 16 habitat patches. The habitat would be very similar to the existing conditions and have the same effects as Alternative E. The critical connective habitat corridor along Hills Creek would be maintained.

Dead and Defective Tree Habitat

Alternative F would leave 100 percent of potential population capacity for cavity nesters on harvested lands (3.8 hard snags per acre). Green trees would be left (3.8 per acre) to maintain the 100-percent level through the timber stand rotation by being converted to hard snags at Year 30. One additional green tree per acre would be left under this alternative to supplement the smaller 15- to 17-inch diameter hard snags at Year 60.

The cumulative percentage of potential population capacity of cavity nesters by subwatershed would not change from existing conditions.

Riparian-Dependent Species

Salvage activities would take place on 16 percent (399 acres) of the remaining riparian habitat within the project area. Since stream buffer prescriptions are the same as those for Alternative C most impacts would be similar to those for Alternative C. This would produce some reduction in habitat quality and usability for wildlife. The effects would be similar to those effects described under Alternative B except the impacts would occur on less area. Some Class IV tributaries may have protective buffers under this alternative; thus, total acres impacted may be reduced.

Threatened, Endangered, and Sensitive Species

Habitat would be managed for the northern spotted owl under this alternative to provide for future habitat suitability. The Bull Creek SOHA would be retained with 971 acres of available suitable habitat and 529 acres of unsuitable habitat. This 529 acres is classified as unsuitable because much of the multi-layered canopy has been reduced or eliminated and the canopy closure is less than 50 percent. The 529 acres of unsuitable habitat would be enhanced to provide for future habitat. It is estimated that the Bull Creek SOHA would meet northern spotted owl management requirements in 80 to 120 years. Managing this SOHA would provide the opportunity to monitor this spotted owl pair to determine their use of the acres classified as unsuitable and to determine if this pair of spotted owls would successfully reproduce in a suitable and unsuitable habitat mixture.

CULTURAL

INTRODUCTION

Cultural resources that are eligible for listing on the National Register of Historic Places can be reduced in value by any change in the quality of their historical, architectural, archaeological, or cultural character. The criteria for eligibility are listed in Code of Federal Regulations 36 CFR (CFR 1988b) and Section 101 (a)(1)(a) of the National Historic Preservation Act of I966 (U.S. Congress I966). The American Indian Religious Freedom Act of 1978 (U.S. Congress I978) protects the "inherent right of freedom to believe, express, and exercise their traditional religions." This includes, but is not limited to, access to sites, use and possession of sacred objects, and the freedom to practice traditional worship ceremonies. Ground-disturbing activities have a potential to affect historic and prehistoric sites.

The potential for disturbing cultural resources in the project area is greatest where road and trail construction, timber harvest, and site preparation activities are proposed. Cultural resources can also be affected by recreation developments and by people using the area for recreation.

Cultural resource inventories are required prior to road construction, timber harvest, and other ground-disturbing activities. Other compliance procedures required under Section 106 of the National Historic Preservation Act must be observed. An agreement between the Willamette National Forest and the Oregon State Historic Preservation Office (SHPO) has expedited this procedure because of the special circumstances of this project.

The Willamette National Forest Sample Survey Design (USDA Forest Service 1988d) approved by SHPO, prescribes the level of coverage required for an adequate survey. The method is based on the probability of locating cultural resources. The Shady Beach fire affected approximately 9,000 acres; of that amount 1,800 acres (25 percent) are High Probability Area and the remaining 7,200 acres (75 percent) are Low Probability Area. When the survey was performed, 25 prehistoric archeological sites were located. Twenty-four of the sites had been located during previous surveys in the area. Twenty-three of the sites have been disturbed because of road construction and timber harvest. Two of the sites are undisturbed and may have potential for adding to the knowledge of prehistory of the area.

EFFECTS COMMON TO ALTERNATIVES B, C, AND F

Alternatives B, C, and F would all have the same affect on cultural resources. The two undisturbed archaeological sites would be impacted by road construction and timber harvest. The effect would be direct because of the disturbance. Since cultural resources are non-renewable, the affect on the sites would be irreversible. For this reason, the sites will be evaluated for significance and mitigated if found significant and eligible for the National Register of Historic Places. The evaluation and mitigation will include excavation of a portion of the sites with analysis and documentation of generated information. The evaluation and mitigation will occur prior to any construction or harvest activities.

ALTERNATIVE E
NO ACTION

Because no activities are planned, cultural resources would remain undisturbed except for the natural deterioration of sites over time. Weathering of fire-exposed sites would accelerate.

ALTERNATIVE D

This alternative would have a similar affect on cultural resources except the two undisturbed archaeological sites would be affected by timber harvest only. The effect would be direct because of the ground disturbance caused by yarding of logs. Since cultural resources are non-renewable the affect on the sites would be irreversible. For this reason, the sites will be evaluated for significance and mitigated if found significant and eligible for the National Register of Historic Places. The evaluation and mitigation will include excavation of a portion of the sites with analysis and documentation of generated information. The evaluation and mitigation will occur prior to any harvest activities.

RECREATION

INTRODUCTION

Recreation settings occur throughout the planning area and provide a range of recreation opportunities. Changes in the characteristics of the area will affect the recreational experience of the Forest visitor. Developed recreation sites attract visitors due to the facilities provided. Characteristics of the adjacent areas also contribute to the quality of a developed recreation setting. The dispersed recreation settings are attractive due to road and trail access, the presence of fish and wildlife, and the scenic quality of the landscape.

EFFECTS COMMON TO ALL ALTERNATIVES

Due to the fact that recreational use patterns in the fire area consisted of largely driving and hunting and that no developed campgrounds or hiking trails were actually located within the fire perimeter, there is no foreseen permanent effects on recreational use. Hiking use on the Tufti Creek Trail and boating and picnicking use at C.T. Beach will only be temporarily disrupted during the life of the salvage operations. All use of the recreation facilities and fire area can be accommodated by other local trails, campgrounds, and general forest areas along Hills Creek Reservoir.

Forest visitor use of the planning area would remain at nearly the current levels regardless of management practices. These levels of use are discussed in the Recreation section of Chapter III. Firewood cutting would be available at current levels as timber sales are planned and logged according to the Forest's timber sales schedules. Fishing by Forest users would continue at current levels as the major fishing activity takes place outside the fire-damaged areas. Hunting use of the fire area may drop until vegetation in the burned areas recovers and forage is again available. The hiking trails in the planning area were not affected by the fire and use may increase as visitors come to view burned areas. Driving use by Forest visitors will increase during the next few years as they visit the fire area to view the effects of the fire.

There are many opportunities to provide educational information through interpretive measures in the fire and planning areas. These opportunities are discussed briefly in Chapter II under Features Common to All Alternatives (Mitigation/Enhancement section). Interpretive facilities would mitigate, to some extent, negative reactions to the fire and harvesting activities.

Primary impacts upon developed recreation sites users would be the slight possibility of debris entering Hills Creek Reservoir. This debris would create hazards for boaters and skiers.

EFFECTS COMMON TO ALTERNATIVES B, C, D, AND F

Effects on dispersed recreational activities would primarily be along the Tufti Creek Trail #3624 and along that portion of Forest Road 2118 from the junction of Forest Road 23 to the Bull Creek drainage (on the main arm of the Hills Creek Reservoir). Short-term effects would involve closure of the Tufti Creek Trail during harvest of areas across Hills Creek from the trail. Other logging activities along Forest Road 23 and Hills Creek would displace fishing and dispersed camping use on Hills Creek. These effects would extend from the reservoir to Landes Creek. Dispersed camping would likely be displaced at the Modoc Creek Cove on the main arm of Hills Creek Reservoir if timber harvest activities take place during the summer season.

As detailed in the Water and Fish section of this Chapter, fish populations would not be significantly affected so fishing in Hills Creek and Hills Creek Reservoir would not be affected.

Long-term effects would largely involve the loss of standing old-growth as viewed by hikers from the Tufti Creek Trail. Views of the harvested slopes across Hills Creek would be partially screened by timber stands remaining along Hills Creek. There would also be some long-term effects on the ability to drive in portions of the analysis area as some roads would be closed for all or portions of the year to minimize disturbances on wildlife.

For all action alternatives, logging traffic would increase for the duration of salvage harvest operations. This would increase the potential for conflicts between log-hauling traffic and recreational traffic. Road restrictions for recreational traffic on gravel roads through the harvest area would be imposed for safety considerations, causing short-term effects on recreational driving.

All action alternatives would provide a large increase in firewood-cutting opportunities. These increases would be correlated to the amount of volume harvested by each alternative.

ALTERNATIVE E NO ACTION

This alternative would provide a source of speculation among viewers concerning the fire-killed stands of timber. Visitor use at Cline Clark may actually increase as the parking lot provides the only pull-out for parking along the portion of Forest Road 21 between Hills Creek Dam and Packard Creek Campground. Views of the fire area on the Hills Creek Reservoir is best seen from this parking lot.

ALTERNATIVE B

Timber salvage activities would not have a measurable effect upon Forest visitors utilizing Packard Creek Campground, Cline Clark picnic area, or C.T. Beach picnic area and boat ramp. Views from these areas would reveal expanses of clearcutting. This alternative would have a moderate effect on the quality of these vistas.

ALTERNATIVE C

Effects are the same as covered under Alternative B.

ALTERNATIVE D

Timber salvage activities would not have a measurable effect upon Forest visitors utilizing Packard Creek Campground, Cline Clark picnic area or C.T. Beach picnic area and boat ramp. Views from the Packard Creek beach and the Cline Clark parking lot would be moderately to slightly degraded in the short-term due to the large use of partial cutting proposed in areas visible from these sites.

Increased acreages of proposed partial cutting would provide more viewing opportunities of standing, mature timber for dispersed recreational users of the fire area.

ALTERNATIVE F

There would be a small effect on the views from Packard Creek Campground, Cline Clark picnic area, and C.T. Beach picnic area and boat ramp due to the partial cutting that would take place across the reservoir from these sites.

This alternative would leave numbers of old growth to view from the Tufti Creek Trail. These trees would help screen clearcutting upslope from the trail.

VISUALS

INTRODUCTION

The visual resource analysis estimates how the potential timber harvest, and the potential road construction would affect the visual quality of the fire influenced natural landscape and Visual Quality Objectives (VQO).Retention foreground and partial retention middleground are the scenic management land allocations affected by the fire recovery project. None of the alternatives except No Action, would meet the VQOs in the first decade. The VQOs are defined in Chapter II as derived from the Proposed Forest Plan/DEIS and USDA Forest Service Landscape Management Handbook (1974). The standards and guidelines are prescriptions to meet the VQOs. Each alternative was analyzed to find how well it would meet or exceed the VQOs. Figure IV-61 displays these effects by alternative. Each alternative is presented to show the significance of these effects.

VISUAL QUALITY OBJECTIVES
BY ALTERNATIVE

INDICATOR	B	C	D	F	E
Retention Foreground					
----Proposed Plan/DEIS harvest rate per decade	5	5	5	5	5
----first decade harvest rate (%)	14	10	9	9	0
----openings over 15 acres in size	5	2	3	3	N/A
Partial Retention Middleground					
----Proposed Plan/DEIS harvest rate per decade	10	10	10	10	10
----first decade harvest rate (%)	35	26	21	19	0
openings over 5 acres in size	19	12	9	5	N/A
Recovery Rate of Vegetation to meet VQOs* (years)	30	30	30	30	30

Figure IV-61 Visual Quality Objectives by Alternative

EFFECTS COMMON TO ALTERNATIVES B, C, D, AND F

Percent Harvest Rate Per Decade and Opening Size

The standards and guidelines under the Proposed Forest Plan/DEIS call for a 5- and 10-percent per decade harvest rate in retention foreground and partial retention middleground respectively. All of the action alternatives would exceed these rates for the first decade. A cummulative effects analysis would show harvested areas in a disturbed state until a 20 foot tree height is attained. In most cases this would take up to 30 years. Figure IV-61 shows visual quality objectives by alternative and includes presently managed stands less than 8-years-old, plus the proposed timber harvest.

Exceeding the planned harvest rates would alter the natural landscape form, line, color, and texture for both the short- and long-term. Immediate effects would be the increase in canopy openings beyond that which would occur under the planned rotations. It will take up to 30 years for harvest areas to meet VQOs assuming there are no more entries into the area.

Activities which may result in deviations from the newly established natural pattern of the landscape are the elements which must be judged against the VQOs identified in the Proposed Forest Plan/DEIS. These activities may include; 1) harvest unit boundaries which do not follow the exact edge of fire-killed clumps of trees, 2) new harvest units in unburned areas, 3) road construction or existing roads now visible due to the death and/or removal of trees, 4) landing construction, 5) disposal of debris from the above activities, and 6) site preparation or fuels reduction. Use the Forest Visual Adsorption Capability (VAC) map to assist in determining the portions of the burned area which have a high, moderate, or low capability to adsorb the visual impact of these activities.

Opening size also causes a dramatic affect on the landscape. All the action alternatives would result in openings over the 5- and 15-acre standards for retention and partial retention visual quality objectives. Average harvest area size would be 36 acres in partial-retention land allocation with a range of 16 to 65 acres, while retention allocations would contain an 11-acre average harvest area size with a 6- to 25-acre range. While every acre of all these harvest areas would not necessarily be seen, these larger-than-standard size openings in these visual areas would have the same long-term impacts mentioned for the harvest rate changes.

Logging Slash Disposal

Logging slash would be broadcast burned within the viewshed. Burning effects on the landscape would be short-term, since the blackened landscape would have green vegetation within the first 5 years. Logging slash in visually sensitive roadside areas would be piled and burned.

Logging System and Harvest Area Design

The type of logging system to be used would affect landscape appearance. Helicopter logging would allow for latitude in varying the shape and form to blend harvest areas with the surrounding landscape. Burned timber concentrations closely followed the natural landscape configuration. Harvest areas which would follow the tree mortality boundaries would blend with the landscape. Helicopter logging would generally result in little soil disturbance, therefore contributing to a more natural appearance. Although helicopter logging would require less road construction within the visually sensitive areas, helicopter log landings would be more visible due to their size requirements and the need for cleared flight paths into them. Helicopter logging along Hills Creek Reservoir will require log landings along the reservoir itself, but these are not expected to be in great contrast with the landscape.

Conventional logging systems such as skyline and high-lead cable would have an impact on the natural landscape due to geometric cutting areas and soil disturbance from dragging logs. Harvest areas logged in this manner would contrast with landscape color, line, and form.

ALTERNATIVE E NO ACTION

No management activity is proposed in this alternative. Site disturbing activities would not exist and though the natural landscape has changed, there would be no other effects on the scenic resource. Two expansive areas seen from the west shore of the Hills Creek Reservoir have concentrations of 100 percent mortality. These areas are located in the headwaters of the Modoc Creek drainage west of Tufti Mountain and the headwaters of an unnamed drainage about one-half mile north of Tufti Mountain. These and other middleground landscapes mow appear as combinations of black or tan openings on green slopes or as pockets of green on black or tan slopes, depending upon vegetation patterns and burn intensities. As time passes, the tan will change to areas of black, then to light grey, and then to green as vegetation re-establishes itself. The first light grey and greening effects will occur in two to five years. The overstory trees will take from 30 to 50 years to become re-established due to the difficulty trees have in regenerating naturally on these rocky, west-facing slopes.

In addition, numerous small areas of high mortality occurred on the hillside extending south to to the Bull Creek drainage. Individual trees scattered throughout these stands were killed and will remain as scattered black and silver snags, becoming natural structures of the landscape.

Alternative E would provide the most natural appearing recovery beginning with herbaceous and shrubby plants establishing themselves in two to five years and a closed canopy of trees becoming established in about 30 years.

ALTERNATIVE B

This alternative stresses the use of conventional logging systems and the removal of incidental green timber to make logical timber harvest areas. An extended road system would access the majority of the harvest areas.

This alternative would harvest 14 percent of the foreground area. This area, as seen from Forest Road 21 and recreational areas, would show dominant alterations of the natural landscape. Management activities in the foreground would be visually evident due to the number of harvest areas to be logged with conventional equipment.

This alternative would harvest 35 percent of the middleground area, creating contrast dramatically in scale, line, form, texture, and color with the natural landscape. The most significant alterations would occur in the drainage across from Cline Clark picnic area and in the area from Modoc Creek to 1 mile south. These changes would be visually dominant and would attract the attention of a viewer. The long-term effects of the harvest areas would last 30 years until the stand's crown texture is similar to that of the adjacent stands.

ALTERNATIVE C

Alternative C would harvest and regenerate fire-damaged stands that fall below the 60 percent stocking level (in visual areas) and would, therefore, change the characteristic dense conifer texture. This alternative would harvest 10 percent of the foreground area, resulting in a visit where management activities would dominate the characteristic landscape. Effects from conventional logging system harvest areas would be similar to those in Alternative B. As viewed from Packard Creek Campground looking north, management activities would be out-of-scale and contain elements of line and form that are incongruent with other activities in the area.

Management activities in partial retention would dominate the landscape with 26 percent of the middleground area to be harvested. This condition would change over approximately 30 years when the stand crown closure reaches 70 percent. Contrasts in color would be be significantly reduced within 30 years.

ALTERNATIVE D

Under this alternative, 9 percent of the foreground and 21 percent of the middleground area would be harvested. There would be few green trees harvested, so the cutting area boundaries would follow the natural burn pattern. These would appear as natural meadow openings. The majority of the harvest areas would be helicopter logged, contributing to boundaries which would match the natural landscape. The cutting area openings would be dispersed across the landscape and would be visually dominant. However, these contrasts would repeat the line, form, and scale that occurs naturally.

ALTERNATIVE F

Alternative F would harvest 9 percent of the foreground and 19 percent of the middleground area. The established wildlife habitat corridors and the spotted owl habitat area (SOHA) that would be retained in the Bull Creek area under this alternative would have large amounts of dead, standing timber. These would become open areas with dead, silver snags, contrasting with the color and texture of other landscape openings. Since only the clearcut areas would be replanted under this alternative, natural regeneration would be relied on to revegetate partial cut stands. This would extend the time it would take for the natural conifer texture to return to the landscape.

DEVELOPMENTS AND IMPROVEMENTS

Developments in the analysis area represent a substantial investment and as such, would be protected as much as possible in all of the action alternatives.

EFFECTS COMMON TO ALL ALTERNATIVES

There would be no effects on the power generation facilities at the Hills Creek Dam, the Boy Scout camp at Kitson Hot Springs, the Southern Pacific Railroad right-of-way, the communications facilities on the summit of Wolf Mountain, the Packard Creek Campground, or Cline Clark and the C.T. Beach day-use recreation areas from any of the alternatives. There are no activities proposed in the vicinity of these developments except viewing of logging.

EFFECTS COMMON TO ALTERNATIVES B, C, D, AND F

Log-truck traffic would wear the surface of all gravel roads receiving any amount of use. Approximately 1 inch of gravel would be removed for each 10 million board feet of timber transported over a given road. Timber sale contracts would provide for replacement of the lost surface rock based on the amount of traffic occurring on a given road. Approximately 63,000 cubic yards of gravel would be quarried within or close to the analysis area to replace the lost road surfacing. Approximately 92,000 cubic yards of gravel (total) would be used.

There would be some minor effects on the sedimentation rates of Hills Creek Reservoir as detailed in the Water and Fish section of this Chapter and the following Minerals and Energy section. These effects would be insignificant, of short duration, and would not effect the design life of the reservoir as a flood-control structure.

EFFECTS COMMON TO ALTERNATIVES B AND C

Implementation of Alternative B would add 21.2 miles, excluding temporary roads in areas, to the existing road system, and Alternative C would add 18.1 miles. Both alternatives would increase the potential for landslides along roads due to the approximately 20-percent increase in miles of road in areas with high and moderate potential for mass wasting. Potential for debris slides and torrents in draws would be increased due to the approximately 100-percent increase in the number of Class III and Class IV streams crossed by roads. Some existing roads would need additional rock surfacing or culverts.

ALTERNATIVE E
NO ACTION

There would be no effect on the road system aside from the increased possibility of mass wasting due to fire effects. Mass-wasting effects are discussed in the Soils section of this Chapter. This increase would result from forest mortality and would occur mainly where roads cross steep draws or streams, where roads have been built across over-steepened topography, or where cut slopes exceed the angle of repose for a given soil. Although this alternative would not utilize the existing road system, the roads would still be maintained to facilitate the management of the many plantations in the areas and to provide for travel through the analysis area. These roads would also be maintained to provide for access to projects within the analysis area that have already been approved. There would be no additional wear on gravel-surfaced roads and no need to quarry replacement rock.

ALTERNATIVE D

Implementation of this alternative would add 0 miles to the existing road system, except for temporary spurs in harvest areas. The only effects on the existing system would be replacement or thickening of rock surfacing or additional culverts where needed for project operations.

ALTERNATIVE F

Implementation of this alternative would add 11.2 miles, excluding temporary roads in harvest areas, to the existing road system. The potential for road-related slope failures would slightly increase due to the approximately 5-percent increase in roads in highly burned areas with high and moderate potential for mass wasting and due to the approximately 15-percent increase in crossings of Class III and Class IV streams. Some existing roads would need additional rock surfacing or culverts.

MINERALS AND ENERGY

MINERALS

None of the alternatives would effect mineral potential, rights, reservations, or withdrawals in the analysis area.

EFFECTS COMMON TO ALTERNATIVES B, C, and F

All alternatives, except D and E, would provide different amounts of new road access, which would have the indirect effect of improving access for exploration or development of minerals. Quantities of rock needed for road surfacing varies among alternatives due to varying numbers of miles of new road construction. Rock needs will be met from existing quarries and from suitable rock found along or near new construction. The overall supply of rock suitable for road surfacing in the analysis area will not be significantly depleted by the project.

ALTERNATIVE E NO ACTION

Because access would remain the same, exploration for minerals would not be improved. There would be no effect upon administrative quarrying since access to existing quarry sites would not change.

ENERGY

EFFECTS COMMON TO ALL ALTERNATIVES

Hydroelectric power is generated from the Hills Creek Reservoir and other downstream reservoirs on the Middle Fork of the Willamette River. The fire burned at high intensity on less than 2 percent of the 262,871 acres of the area that drains into the reservoir. The theoretical increase would be about 17 percent in about 2 percent of the flow or about 0.3 percent (0.003) increase in the flow of the Middle Fork of the Willamette River. This would produce a theoretical increase in the water yield from the drainage, but it would be unmeasurable and insignificant to the total flow into the Hills Creek Reservoir. In addition, this small increase would last only until vegetation recovers to pre-fire densities, which would take 10 to 15 years. Therefore, the effect on the production of hydroelectric power would be negligible (Tami l989).

There would be no effect upon potential geothermal resources or upon the known resource at Kitson Springs as all potential activities in all alternatives would effect only features on or above the ground surface.

SOCIAL AND ECONOMIC

INTRODUCTION

The economic and social impacts of each alternative are discussed in quantitative terms. Additional social impacts which might best be expressed in qualitative terms, such as the "quality of life", are addressed in sections describing impacts on wildlife habitat, water quality, and scenic views (visuals).

The economic and social analyses are divided into two categories.

1. The socioeconomic impacts on surrounding communities are estimated for the following variables by alternative: 1) numbers of jobs, 2) dollars of wage income, and 3) dollars returned to the counties via the Twenty-Five Percent Fund Act of 1908 (U.S. Congress 1908). All three variables are specifically related to the timber volume offered by each alternative.

2. The economic efficiency of each alternative's timber sale program and resource mitigation/enhancement/monitoring projects is analyzed in two ways: 1) net benefits are determined for revenues and costs that occur during the recovery and timber salvage operations for the first 2 years, 1989 and 1990; and 2) present net value (PNV) is estimated for recovery and salvage operations and for all future volumes of timber harvested over a 50-year time period.

The methodologies and models used to assess present and future economic impacts are presented in detail in the paper titled "Economic and Social Analysis for the Shady Beach Fire Recovery Project, 1989". This paper is part of the process records for this document. Also, a detailed listing of revenues and costs by activity by alternative are presented in Appendix F, Economics. The methodologies/models are consistent with the process used in preparing the Proposed Forest Plan/DEIS for the Willamette National Forest (WNF) which is scheduled for final approval in 1989. Price and cost data are developed specifically for this project and reflects current actual revenues and costs for this geographical area.

Assumptions

There are several assumptions made in modeling and estimating monetary impacts. The assumptions are listed as follows.

1. The timber volumes estimated by alternative are those that would actually be merchantable when harvested if that alternative were to be implemented. Volumes discussed in this section are defined by the term "expected merchantable" volume. Losses in volumes and/or values by year of harvest due to deterioration are adjusted for in the expected merchantable harvest volumes. On this project, there is no volume loss assumed for volumes which would be harvested in Year 1 (1989). For volumes harvested in Year 2 (1990), there is a 10-percent volume loss assumed (for further discussion on volume

and value losses due to deterioration, refer to Appendix C, Silviculture or Appendix F, Economics).

2. The salvage operation would be completed in the next 2 years (1989 and 1990). All harvest units adjacent to the existing road system, including helicopter units, would be harvested in 1989. All harvest units which would be accessed by the extended road system, including the respective helicopter units, would be harvested in 1990.

3. An average of 40 percent defect, including breakage, is applied to gross volumes to yield the net volume. One-half of this defect volume has some merchantable value; therefore, 80 percent of gross volume is used in calculating the total stumpage value for volumes harvested in 1989. Because there is an additional 10-percent volume loss for volumes harvested in 1990 (Year 2) due to deterioration, 70 percent of gross volume is used in calculating total stumpage value for 1990.

4. Revenues and costs are determined from local data, e.g., Rigdon Ranger District sales on similar geographic sites. Costs are in constant 1988 dollars and are estimated from the period of 1985-1988. Revenues are based on Rigdon Ranger District Sales sold in 1988-1989. Revenues and costs realized in future green sales are assumed to increase throughout time at some same rate; therefore, the values are not further inflated in the PNV calculations. Relatively speaking, this will not affect comparisons of monetary impacts between alternatives.

5. In this particular project area, the primary resource demand is for timber. The fire will not affect recreational use in the Hills Creek area. Big-game hunting opportunities are not expected to be adversely affected by the fire. Many roads will remain open to the public. Additionally, there are many recreational/hunting opportunities in adjacent areas. Therefore, timber resource is the only resource assigned a market value in this analysis. Consequently, the net benefit, PNV, and 25-percent county payment calculations are based solely on the timber resource.

6. Harvest units containing green volumes within the project area will be harvested in accordance with the respective land allocations in future years. A 50-year time period is used for scheduling future timber harvesting in the PNV calculations. This time period is consistent with the time period used in the Forest planning process by the WNF for unmanaged stands. Future timber sales are scheduled and discounted back at mid-decade, i.e., Year 5, Year 15, etc. A 4-1/8 percent discount rate is used in calculating the PNV's.

7. In addition to any roads built to access salvage sales within the next 2 years, the transportation system will be fully developed within the next 3 decades for the entire project area. The cost of roads to

access green volumes in the next 50 years is depreciated out over 3 decades.

8. The majority of the salvage sale volume will count towards the WNF annual sale volume.

9. Sawmill and veneer plant, tree planting, and road construction technology will remain the same throughout the 50-year planning horizon, e.g., capital to labor ratios will remain the same.

Stumpage Value

The stumpage price per thousand board feet (MBF) is based on gross volume; 60 percent of the volume is valued as Douglas-fir board foot value, 20 percent is valued as per acre material (PAM) for chips and other by-products, and 20 percent has no value. This stumpage price estimation assumes that 50 percent of the average 40 percent defect has some merchantable value. The stumpage value is also adjusted to reflect road purchaser credits (RPCs) and logging costs that are consistent with logging costs (variable costs) and road costs (fixed costs) estimated by the NETWORK model for Alternative A, the maximum timber alternative. The costs estimated by NETWORK for this alternative represents a baseline for measuring variable and fixed costs for other alternatives with multiple resource objectives. A weighted average stumpage value is $292, assuming no value loss due to deterioration (this value is weighted 75 percent Douglas-fir board value and 25 percent PAM value on a gross merchantable volume basis). This value represents an average high-bid value from Rigdon Ranger District sales on similar geographic areas from 1988-1989. The stumpage values applied to salvage harvests in years 1989 and 1990 are $278 and $266, respectively. These values account for a 5-percent value loss in 1989 and a 9-percent value loss by 1990 due to fire effects and deterioration. This value loss is in addition to the assumed 10-percent volume loss in 1990.

Mill-Pond Value

A mill-pond value is determined by adding logging costs, including fuels (slash) treatment costs estimated by the NETWORK model for the maximum timber alternative onto the stumpage (high bid) values. This methodology for calculating a mill-pond value will account for the reduction in stumpage revenues as a result of increases in variable (logging) costs and/or fixed (road reconstruction) costs in each successive alternative. The mill-pond value used for future green sales is $394 per MBF, $380 for salvage sales harvested in 1989, and $368 for salvage sales harvested in I990.

Costs

1. Logging costs range from $79/MBF to $156/MBF for conventional (e.g., cable and skyline) logging systems and helicopter logging, respectively. These costs include a per MBF cost for road maintenance.

2. A per acre cost of $386 includes planting, animal control, survival exams, and sales preparation and administration.

3. Fuel treatment costs range from $34 per acre ($34/acre) for extra protection to $406/acre for broadcast burning. Some units may receive no treatment and others may have slash hand piled on sensitive areas next to roads only.

5. Mitigation, monitoring, and additional rehabilitation costs for specific resources vary by resource project and alternative. The costs are listed for each alternative (see Table F1, Appendix F).

Project Appraisal Estimates

For each alternative, economic analyses include estimates of: 1) net benefits for the first 2 years, 2) present net value for a 50-year, timber-sales planning horizon, including the salvage sales in 1989 and 1990, 3) payments to counties from harvested timber volumes, and 4) direct jobs and income generated from the timber sales program in the project area. Each project appraisal estimate is described below.

1. Net Benefits - Net benefits or net revenues is the difference between revenues generated by an alternative and the costs to implement the alternative. The net benefits are for the salvage sales program and mitigation/monitoring/enhancement projects (1989-1990). There is no discounting applied to this dollar estimate.

   Revenues represent the selling or market value of logs at the mill (mill-pond value equals stumpage value plus logging costs). Costs include: 1) logging costs incurred by the logger, and 2) sales preparation and administration costs, road construction costs, regeneration costs, fuels treatment costs, and mitigation costs incurred by the Forest Service (FS) in offering and administering the sales and/or additional mitigation costs separate from the timber sales program.

2. Present Net Value (PNV) - The PNV includes future benefits and costs of timber sales which will be offered in the next 5 decades in addition to the benefits from the salvage sales in Years 1 and 2. However, all benefits and costs are discounted back to the present time (1989) from the year that the activity actually occurs, including the salvage sales. Discount rates of 4-1/8 percent and 7 percent are used in the PNV calculations. The 4-1/8 percent rate is the accepted Forest Service rate and represents a long-term real rate of return on AAA corporate bonds for the period of 1960 to 1978. The PNV calculation presents the present-day value of a long-term investment, accounting for an interest rate on dollar benefits and costs which will be realized only in future years.

3. Payments to Counties - By direction of the Twenty-Five Percent Fund Act of 1908 (U.S. Congress 1908), 25 percent of all revenues returned to the Federal treasury from the sale of commodities or user fees collected from Forest Service lands are returned to counties on a per acre basis. Of the six counties receiving payments from the Willamette National Forest (WNF), Lane County receives 60

percent of the annual payments. On the WNF, more than 99 percent of all revenues collected are from the sale of timber. The 99 percent includes timber receipts, road purchaser credits, and collections made under the Knutson-Vandenberg (K-V) Act of 1930 (U.S. Congress 1930). The 25-percent payments are calculated from these monies.

Alternatives B, C, D, E, and F will contribute to Twenty-five Percent Fund payments in fiscal years (FY) 1989 and 1990. In FY 1989, monies contributed to the Timber Salvage Sales Fund (TSSF) will also be shared with the counties. The TSSF monies are not normally included in the payments-to-counties calculations. Congressional action in the 1988 and 1989 Appropriations Bill has included this fund due to the large volume of FS timber burned in the past 2 years. It is unknown at this time if this action will be extended into FY 1990. County payments will not increase if the salvage volumes and future green volumes in the project area are a part of the WNF's annual allowable timber sales program. In other words, green volumes that would have otherwise been harvested or offered for sale on the WNF will be delayed due to the salvage sales and harvesting in the analysis area.

4. Jobs and Income Dollars Generated from Salvage Sales - Jobs and income for the timber and associated industries will be estimated for the 2-year salvage operation and for green sales in the next 5 decades. This includes logging and mill jobs, tree planting jobs, road construction and maintenance jobs, and FS jobs. Teachers' salaries and county road construction/maintenance jobs supported by the Twenty-Five Percent Fund Act payments are not included in these figures. Jobs resulting from other industries which sell "intermediate" products to the lumber and wood products sectors (indirect jobs), and jobs resulting from increased household spending in the services and retail trade sectors (induced jobs) can be estimated by applying a multiplier of two to the direct timber industry jobs. Industry-specific multipliers are estimated in the FS IMPLAN input-output model for each of the above direct job categories. (Specific information may be found in the Shady Beach Fire Recovery Project analysis files - "Economic and Social Analysis Process Paper.")

   The following figures are used to calculate direct jobs. Timber industry jobs per million of board feet (MMBF) are estimated from the FS IMPLAN input-output model and verified with local mill data. Forest Service, tree planting, and road construction jobs are determined from primary local data. The numbers used to estimate jobs by alternatives are listed as follows: 1) 4.4 jobs per MMBF is the weighted average of jobs/MMBF for the logging, sawmill and planing, and veneer plant sectors, 2) 0.9 jobs per MMBF represents FS jobs/MMBF assuming that the timber sales program supports 80 percent of jobs on the WNF, 3) 12 jobs per 10 acres planted daily is the number of tree planting jobs, and 4) one job per 1 mile of road built represents jobs in the construction sector. All jobs are full-time equivalent (FTE) jobs. The respective hourly wages are 1) $10, 2) $9, 3) $10, and 4) $11. These average wages represent 1988 wages for the respective jobs in the Oakridge/Westfir area.

EFFECTS COMMON TO ALL ALTERNATIVES

In the following alternatives discussion, expected merchantable volumes of timber and net benefits and PNV's are presented. A detailed listing of revenues and costs by individual activity, i.e., regeneration costs, are presented by alternative in Tables F1 through F3 (see Appendix F, Economics).

The costs of replanting 1,700 acres of managed stands (plantations) in 1989 and 1990 are included in each alternative. Eight hundred acres are planted and 300 acres are mulched in the first year at a cost of $353,800 (present value cost (PVC) of $339,767). Nine hundred acres are planted in the second year (because of a lack of Douglas-fir seedling stock) at a cost of $347,400 (PVC of $320,389).

ALTERNATIVE E NO ACTION

There is no salvage of burned timber under the No Action alternative. In addition to emergency rehabilitation projects, the only immediate rehabilitation measure is to replant the two existing plantations within the fire perimeter (refer to the section, "Effects Common to all Alternatives"). The net benefit for 1989 and 1990 would be -$701,200 (PVC of -$660,156). The six counties with WNF acreages would not receive any monies from this alternative in 1989 and 1990.

For the purpose of scheduling future green timber sales, there are 834 million board feet (MMBF) of green timber on 13,433 acres within the entire project area. The stumpage value is applied to 80 percent of the gross volume; 667 MMBF have some merchantable value. A harvest schedule for the green volume is to harvest 20 percent of the volume each decade (133.4 merchantable MMBF) for the next 5 decades starting at Year 5 (1993). This harvest schedule assumes that all acreages are designated as General Forest and follows the WNF's FORPLAN harvest schedule model for general forest land allocations. All harvested acres would be planted. The road system would be fully developed in future years and includes 53 miles of new roads at a cost of $4,996,993. All roads are assumed to be built by the third decade. One-third of the total road costs is allocated to each of the first 3 decades.

The net PNV to the Federal treasury would be $77,018,320. The gross PNV to the Federal treasury for use in calculating 25-percent, revenue-sharing payments to counties is $80,050,112 (includes funds for road purchaser credits and regeneration costs). Over the next 5 decades, a PNV of $20,762,528 would be returned to the six counties containing WNF acreages.

In years 1989 and 1990, six full-time equivalent (FTEs) direct jobs would be created by replanting the plantations. The wage income generated by these jobs is $124,800. In the next 5 decades, starting at Year 5, (1993), there would be 3,881 direct jobs associated with the timber sales program, including logging and mill, FS, tree planting, and road reconstruction and maintenance jobs. The total wage income associated with these jobs would be $79,551,680. The total jobs for the 50-year period would be 3,887 jobs and the total wage income would be $79,676,480.

ALTERNATIVE B

Volumes of timber harvested in this alternative are constrained by integrated resource management objectives described in the Current Forest Plan/FEIS and current interim direction. A total expected merchantable volume of 155.2 MMBF would be harvested in 1989 and l990. One hundred eighteen MMBF (76 percent) would be cut in 1989 and 37.2 (24 percent) MBF would be cut in 1990. Of the total volume, 131.9 MMBF (85 percent) is dead, and 23.3 MMBF (15 percent) is green volume.

The net benefit to the Federal treasury would be $38,271,898. The benefit to the treasury for the purpose of calculating the 25-percent payments to counties would be $42,169,900. A total of $10,542,475 would be returned to six counties with WNF acreages for the 2-year period.

A total of 643.9 gross merchantable green MMBF would be available for harvesting in 5 decades starting in Year 5 (1993). However, 22 percent of the acres with green volumes are classified as Scenic II areas. The remaining 78 percent of the acres with green volumes are allocated as general forest. Based on a 50-year time period, the percents per decade allowed for harvesting are 11 percent and 20 percent, respectively. Based on this split of land allocations, 115.2 merchantable MMBF would be cut per decade. There would be 67.9 MMBF of green volume left at the end of 50 years for future harvesting. This volume would be located on Scenic II acres.

The PNV to the Federal treasury would be $103,749,232 for the 50-year time period. The PNV to the treasury for the purpose of calculating the 25-percent payments to counties would be $111,029,072. A PNV of $27,757,267 would be returned to six counties with WNF acreages over the 50-year time period and includes revenues from the salvage sales.

In years 1989 and 1990, the jobs associated with the salvage sales program would be 903 direct jobs. The wage income generated by the 903 jobs would be $18,499,520. In the next 5 decades, starting at Year 5 (1993), the direct jobs associated with future sales would be 3,347 jobs. The income generated by the 3,347 jobs would be $68,602,560. The total jobs for the 50-year period would be 4,250 jobs and the total wage income would be $87,102,080.

ALTERNATIVE C

Volumes of timber harvested in this alternative are constrained by integrated resource management objectives described in the Proposed Forest Plan/DEIS published in 1988. A total expected merchantable volume of 138.2 MMBF would be harvested in 1989 and l990. 105.0 MMBF (76 percent) would be cut in 1989 and 33.2 MMBF (24 percent) would be cut in 1990. Of this expected merchantable volume, 124.3 MMBF (90 percent) is dead volume, and 13.8 MMBF (10 percent) is green volume.

The net benefit to the Federal treasury would be $33,511,328. The benefit to the treasury for the purpose of calculating the 25-percent payments to counties would be $37,492,700. A total of $9,373,175 would be returned to six counties with WNF acreages for the 2-year period.

A total of 653.4 gross merchantable green MMBF would be available for harvesting in 5 decades starting in Year 5 (1993). However, 30 percent of the acres with green volumes are classified in the DEIS visual allocations of 1) retention (1,185 acres), and 2) partial retention (3,261 acres). Seventy percent of the acres with green volumes are allocated as general forest. Based on a 50-year time period, the percents per decade allowed for harvesting are 11 percent, which represents a weighted average for the two visual classifications, and 20 percent for general forest. In each of the next 5 decades there would be 113.6 MMBF harvested. There would be 85.4 MMBF left at the end of 50 years on the 4,446 acres of visually sensitive areas.

The PNV to the Federal treasury would be $97,992,672 for the 50-year time period. The PNV for the purpose of calculating the 25-percent payments to counties would be $105,112,240. A PNV of $26,278,060 would be returned to six counties with WNF acreages, including the salvage sale revenues from 1989 and 1990.

The salvage sales program in Years 1 and 2 (1989 and 1990) would generate 820 direct jobs, including logging and mill, FS, tree planting, and road reconstruction and maintenance jobs. The wage income (before taxes) associated with these jobs would be $16,798,080. In the next 5 decades, starting in Year 5 (1993), future timber sales would generate a total of 3,218 direct jobs and $65,963,040 in wage income. During the entire 50-year period, there would be 4,038 jobs and $82,761,120 in wage income.

ALTERNATIVE D

The objective of Alternative D is to salvage burned (dead) volumes only. Some dead volumes would be left out on the ground or standing to provide for nutrient recycling and wildlife habitat. There is no new road construction allowed; all volumes would be harvested in 1989 (Year 1). The gross merchantable volumes harvested in 1989 would be 133.1 MMBF.

The net benefit to the Federal treasury would be $31,496,285. The benefit for the purpose of calculating payments to counties would be $34,501,600. An amount of $8,625,400 would be returned to counties with WNF acreages in 1989.

A gross merchantable volume of 667.2 green MMBF would be available for future harvesting. However, there are 3,816 acres with green volumes which are classified in the Proposed Forest Plan/DEIS visual allocations of 1) retention and, 2) partial retention. The remaining acres are allocated as General Forest. Based on a 50-year time period, 11 percent of green volume would be harvested per decade on the visuals allocation acres and 20 percent would be harvested per decade on general forest acres. Starting in Year 5 (1993), 116.8 MMBF would be harvested for 5 decades. There would be 83.2 green MMBF left at Year 50 (2039) on the 3,816 visually sensitive acres.

The PNV to the Federal treasury would be $98,214,448 for the years 1989 through 2039. The PNV for calculating the 25-percent payments to counties would be $101,113,952. An amount of $25,278,487 would be returned to six counties with WNF acreages for the entire 50-year period.

The salvage sales in 1989 (Year 1) would generate 763 direct jobs and $15,608,320 in before-tax wage income. Future sales in the next 5 decades would generate 3,401 direct jobs and $69,723,680 in wage income. During the 50-year period, there would be 4,164 direct jobs and $85,332,000 in wage income. The jobs include logging, sawmill and planing, and veneer plant jobs, FS, tree planting, and road reconstruction and maintenance jobs.

ALTERNATIVE F

In Alternative F, the fire area is managed primarily for wildlife habitat and to protect the water/soils resource. Timber harvesting is allowed only when it does not conflict with wildlife, water, and soil resources objectives. A total expected merchantable volume of 95.9 MMBF would be harvested in 1989 and 1990. There would be 91.1 MMBF (95 percent) harvested in 1989 and 4.8 MMBF (5 percent) would be harvested in 1990. Of the expected merchantable volume, 90.6 MMBF (94 percent) is dead volume and 5.3 MMBF (6 percent) is green volume.

The net benefit to the Federal treasury would be $22,959,316. The benefit for the purpose of calculating the 25-percent payments to counties would be $26,437,170. An amount of $6,609,293 would be returned to counties with WNF acreages for the 2-year period.

A total of 661.9 gross merchantable green MMBF would be available for harvesting in 5 decades starting in 1993. Thirty-one percent of the acres with green volumes are classified in the Proposed Forest Plan/DEIS visual allocations of 1) retention and, 2) partial retention. The remaining acres (69 percent) are allocated as general forest. Based on a 50-year time period, 11 percent of green volume would be harvested per decade on the visuals allocation acres and 20 percent per decade on the general forest acres. Starting in Year 5 (1993), 114.4 merchantable MMBF would be harvested for 5 decades. An amount of 89.9 MMBF would be left at the end of 50 years (2039) on the 4,446 visually-sensitive acres.

The PNV to the Federal treasury would be $88,563,024. The PNV for the purpose of calculating the 25-percent payments to counties would be $95,926,888. An amount of $23,981,722 would be returned to six counties with WNF acreages for the 50-year period, including the salvage sales.

The salvage sales program in Years 1 and 2 (1989 and 1990) would generate 560 direct jobs and $11,509,200 in before-tax wage income. In the next 5 decades, future sales would generate 3,320 direct jobs and $68,057,600 in wage income. During the entire 50-year period, there would be 3,880 direct jobs and $79,566,800 in wage income from the timber sales program, including logging and mill jobs, Forest Service jobs, tree planting jobs, and road reconstruction and maintenance jobs.

RELATIONSHIP BETWEEN SHORT-TERM USE AND LONG-TERM PRODUCTIVITY

There is potential for direct, indirect, and cumulative effects on soil from timber harvest and road construction. Losses of long-term productivity are expected to be mitigated by proposed measures, particularly those calling for the retention of large woody material and wildlife reserve trees, protection of all streams, and cool, winter, or spring slash burns. Effects vary by alternative with the amount of management activities.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

There is an inherent risk of increased surface erosion and mass wasting when harvesting timber and building roads in the steep, rugged terrain of the analysis area. Debris slides and torrents may be triggered by construction of road fills and removal of transpiring vegetation in the headwalls and upper parts of steep drainages. In the worst cases, channels are scoured to bedrock and productivity is essentially lost until soil-forming processes rebuild the soil. The level of risk varies by alternative and by the amount of management activity. Proposed mitigation measures are designed to avoid most irreversible soil losses from management activities.

Although the overall supply of rock suitable for road surfacing in the analysis area would not be significantly depleted by any of the action alternatives, the use of rock (92,000 cubic yards) is considered to be an irreversible and irretrievable commitment of resources.

PROBABLE ADVERSE ENVIRONMENTAL EFFECTS THAT CANNOT BE AVOIDED

Implementation of any of the alternatives would result in some unavoidable environmental effects. Although formulation of the preferred alternative and its associated mitigating measures includes avoidance of some potential adverse environmental effects, some adverse effects could occur which cannot be completely mitigated. Some of these effects would be transitory.

Sediment production would exceed natural rates as long as roads are built, timber is harvested, and other soil and vegetation disturbing activities take place. Sediment would be produced by surface erosion, channel erosion, and landslides. Best Management Practices and the additional mitigation measures identified in Chapter II, Resource Impact Mitigation and Enhancement, are designed to minimize negative impacts.

Some disturbance or displacement of fish and wildlife may occur as a consequence of the fire and subsequent timber salvage. Road construction and their use may have an effect on fish and wildlife due to human activities associated with new access into areas previously unroaded.

Ground-disturbing activities would temporarily increase sediment loads locally in streams. This may displace fish, reduce reproduction success, and alter fish prey species populations in stream sections receiving much sediment.

Air quality would be diminished on a temporary, but re-occurring basis, due to fuels-reduction activities or future potential wildfires. Timber hauling and recreational traffic on unpaved roads and the operation of internal combustion engines would have a temporary adverse effect on air quality where these activities occur.

For all action alternatives, the amount and distribution of mature and old-growth forests will be reduced. Since some wildlife species rely on habitat provided by these types of forest, a reduction in the populations of some species can be expected. As the old-growth and mature forest is replaced by young tree plantations, the capability of the fire area to provide thermal cover during the winter months for deer and elk would be reduced.

Fire hazard and resistance to control would increase in the short-term after timber harvest as the result of ground level accumulations of logging residues. Fire ignition risk would also increase as a result of more people using the areas during and after management activities. Wildfire can cause localized loss of soil, wildlife habitat, loss of vegetation, and further increases the potential for increased peak stream flows.

The natural landscape would appear altered under all action alternatives, particularly where harvest activities occur on steep slopes. Slash disposal would also be apparent due to the blacked appearance of burned harvest units. These effects would eventually be eliminated by regrowth of vegetation. Other changes to the natural appearance of the landscape would include roads, especially on steep slopes where construction techniques require movement of large amounts of soil and rock.

Localized adverse effects may result from harvest and recreation activities. These effects include disturbance to vegetation, compaction of soil, reduced water quality, increased noise levels, disturbance of animals and their habitat, and increased potential for human conflict.

POTENTIAL CONFLICTS WITH PLANS AND POLICIES OF OTHER JURISDICTIONS

The effects of implementing any alternative may produce conflicts with the Federal mining laws. The U.S. Mining Laws Act of May 1872 (U.S. Congress 1872) predates all other laws that govern Forest Service activity. Due to this, conflicts may occur between the administration of mining and the management of other resources such as visual quality, water, recreation, and cultural resources.

SPECIFICALLY REQUIRED DISCLOSURES

EFFECTS OF ALTERNATIVES ON THREATENED AND ENDANGERED SPECIES

There would be no adverse effects on any Federally-listed threatened or endangered species or critical habitat as a result of these proposals. Identified bald eagle habitat within the analysis area would be maintained in all alternatives.

EFFECTS OF ALTERNATIVES ON PRIME FARM LAND, RANGE LAND, AND FOREST LAND

All alternatives are in keeping with the intent of Secretary of Agriculture Memorandum 1827 for prime land. The analysis area does not contain any prime farm land or range land. "Prime" forest land does not apply to lands within the National Forest system. In all alternatives, Forest Service lands would be managed with a sensitivity to the effects on adjacent lands.

ENERGY REQUIREMENTS OF ALTERNATIVES

There are no unusual energy requirements for implementing any of the alternatives.

EFFECTS OF ALTERNATIVES ON MINORITIES AND WOMEN

There are no differences between alternatives in effects on American Indians, women, other minorities, or the civil rights of any United States citizen.

Local consumers would be affected by the supplies of various goods and services.

EFFECTS ON WETLANDS AND FLOODPLAINS

No significant effects within floodplain and wetland areas are anticipated. This is due to the very small size of upland wetlands, i.e. small bogs and ponds, and the fact that all the streams in the analysis area are somewhat incised and have very limited or non-existent floodplains.

Protection to the small wetlands that do exist are afforded through mitigating measures such as buffer strips which conform to Executive Order 11988 (floodplains) and Executive Order 11990 (wetlands).

PUBLIC INVOLVEMENT AND COMMENTS

INTRODUCTION

This chapter includes the following sections: 1) Summary of Public Involvement Activities; 2) Nature and Extent of Public Comments; 3) Response to Public Comment; 4) Letters From Federal and State Agencies; and 5) List of Respondents to the Draft EIS.

The Forest Service is directed to respond to public comments by the Council on Environmental Quality Regulations (40 CFR Section 1503.4) for implementing the provisions of the National Environmental Policy Act. See the following Response to Public Comment of this Chapter for more information on how these responses were made.

For more discussion of public involvement in the Project planning process, see the Final EIS Chapter II. The process records (Shady Beach Fire Recovery Project Analysis File) are available at the Rigdon Ranger District office, Oakridge, Oregon.

SUMMARY OF PUBLIC INVOLVEMENT ACTIVITIES

Concurrent with the decision to initiate an Environmental Impact Statement (EIS), was the Forest Service's commitment to fully involve the public in the decision-making process. In order to facilitate the public's involvement, an intense effort was made to initially inform people of the Project, followed by regular updates.

Among the first tasks in the EIS process was to develop issues, concerns, and opportunities. Public participation was essential. Two well-publicized public meetings were held (Eugene and Oakridge) in October, 1988. Publicity for these meetings included about 2,500 notices mailed to individuals and groups, and about 20 notices mailed to media organizations (newspapers, television, radio). Special efforts were made to contact local, state, and Federal government personnel and elected officials, and area environmental and industry groups. A tour of the Project, attended by about 75 people from Eugene and Oakridge, was also conducted prior to the meetings. These meetings yielded many ideas, which, along with written comments, were analyzed by the Project Team, and refined to finalize the list of issues, concerns, and opportunities.

Following the collection of data, the Team next focused on the development of management alternatives for the recovery of the Project area. The public again played a major role. A public meeting, advertised well in advance, was held in Eugene on December 8, 1988, to identify themes from which the Project Team would ultimately develop alternatives. Over 70 people attended, resulting in dozens of themes. Publicity for the meeting came from weekly **UPDATEs**, mailed to citizens interested in the Project, and from media coverage. Throughout the planning process, Shady Beach **UPDATEs** were distributed to a mailing list of over 400 individuals, groups, and media organizations. In all, 14 **UPDATEs** were sent prior to release of the Draft EIS to generally keep the public informed of the Team's progress, and to invite participation at points where review and input by the public was essential. Important topics included the selection of key issues, and later, the range of alternatives selected by the Forest Supervisor. The **UPDATE** also provided a mechanism for those on the mailing list to request a personal copy of the Draft EIS or Summary. About 550 copies of the Draft EIS, and 450 copies of the Summary were distributed to the public.

In order to further involve the public in the planning process, citizens from outside the Forest Service were invited to be on the Interdisciplinary Team (ID Team). They represent The Sierra Club, The Willamette Timbermen Association, and the Oregon Department of Fish and Wildlife. Tours were conducted for environmental and industry groups, and agencies with whom the Team maintained frequent contact, to further assist the ID Team in designing alternatives.

Development of the Draft EIS resulted in considerable public and media interest. The Shady Beach Fire Recovery Project Draft EIS was published in the Federal Register and made available to the public on February 24, 1989. To formally introduce the document and invite comment, a press conference was held in Eugene on February 17. An **UPDATE** was also mailed. A public open house was held in Eugene on February 23 to provide interested citizens information about the Draft EIS and the review process.

The 45-day public comment period ended April 11, 1989, during which time over 30 presentations were given to Forest Service units, and external interest groups and organizations. A bus tour, involving 21 people from Eugene and Oakridge, was held on April 1. Attention was focused on issues of most concern to the public: Wildlife and corridors, riparian areas, mortality predictions, water monitoring, and methodology for silvicultural prescriptions.

NATURE AND EXTENT OF PUBLIC COMMENTS

PUBLIC RESPONSE TO THE DEIS

The Willamette National Forest received over 6,700 responses to the Shady Beach Fire Recovery Project DEIS during the 45-day public comment period. All signed responses were treated as individual documents, and included letters, cards multi-paged papers, and coupons. All but a few came from the state of Oregon, half of which originated in Lane County.

The following is a breakdown of public responses by category, origin, and preferred alternative:

Coupons

Produced and disseminated by area timber industry associations, coupons made up the majority of responses (6,600). Virtually all favored Alternative B. Responses were about equally split between Lane County and the remainder of the state of Oregon. See Chapter V, Response to Public Comment, Planning, for comments expressed on the coupons.

Individual Written Letters

Seventy-six (76) letters were received, about half of which favored Alternative B; the remainder, equally divided among Alternatives C, D, and F. Half were from Lane County; the remainder from the rest of Oregon.

Forest Product Groups/Industries

Sixteen (16) responses were received, all of which preferred Alternative B. Virtually all were from Lane County.

Environmental/ Conservation Groups

Nine (9) groups responded, half of which were from Lane County; the remainder from the rest of the state. All but two preferred Alternatives D and E, or combinations thereof. The others preferred Alternative C if properly modified to meet their concerns.

Government Agencies, Municipalities, Officials

Eleven (11) responses were received, three of which were from cities or civic groups outside Lane County. They preferred Alternatives B and C. State and Federal agency responses were from outside Lane County and were non-committal towards a preferred alternative.

CONTENT ANALYSIS AND EVALUATION OF COMMENTS

Each response was reviewed for comments that met one or more of the following criteria: 1) was substantive in that it addressed the adequacy of our analysis, issues, alternatives, or process; 2) addressed the questions asked by the decision maker; and 3) contained an informed opinion specific to the document. In all, over 400 individual comments were recorded verbatim, categorized, and later summarized for evaluation.

The issues which elicited the most comments from the public and agencies concerned timber supply, wildlife, water quality and fish habitat, and soils. Alternative B was the overwhelming favorite of the respondents (about 6,600 coupons, and over half the written letters). Our evaluation process placed the most weight on activity or resource specific comments which provided rationale and/or reference to support the comments.

In developing the Selected Alternative, the Interdisciplinary Team (ID Team) considered public and agency comments, as well as concerns expressed by Forest Service management.

The FEIS was revised, where appropriate, to respond to substantive comments received from the public and other agencies. Comments which initiated change in the document, or indicated the need for clarification, are included in the Response to Public Comment section.

RESPONSE TO PUBLIC COMMENT

A substantive comment is defined as: "A comment that provides factual information, professional opinion or informed judgement germane to the action being proposed" (Forest Service Handbook 1090.5). The comments in this chapter contain not only "substantive" comments, but also many that expressed a "resource preference" or value. These were included to give the reader a feeling for the broad range of comments received.

Comments to the DEIS are grouped by resource area. Comments were extracted from the letters and may be paraphrased. Every attempt has been made to accurately capture each substantive comment and display them. The comment is presented in boldface type; the Forest Service response follows each comment or groupings of similar comments. There is direct tie between the responses to the public comments and the content of the FEIS. Whenever possible, a reference is made in the response to the exact location in the document wherein the reader may find changes and (or) supporting information.

Comments in this Chapter were included without regard to the author's location, occupation, or lifestyle. Each comment is valuable whether "substantive" or not; opinions, feelings, suggestions, and observations were all read carefully and considered. Use of public comments is not merely a vote-counting process. Each comment was weighed on its own merit against legal, technical, and resource capability constraints. Using professional judgement, the Shady Beach Fire Recovery Project planners assessed and considered all of the public comments, individually and collectively. Many suggestions were incorporated and changes were made to the preferred alternative.

The Shady Beach Fire Recovery Project responded to comments in a variety of ways, which involved:

1. Modifying alternatives including the proposed action.
2. Developing and evaluating alternatives not previously given serious consideration by the agency.
3. Supplementing, improving, or modifying the analyses.
4. Making factual corrections.
5. Explaining why the rationale, authorities and sources were used in the DEIS and why the Shady Beach Fire Recovery Project position is maintained in the FEIS.

SOILS

"Roads should be built only in locations where increased erosion and landslide potential are not high. Steps should be taken to mitigate the effects of road building on soils and water quality."

New system roads have been carefully located to avoid areas with high potential for significant slope stability or erosion problems. Best Management Practices regarding road design, construction methods, and erosion control will mitigate negative impacts on soil and water quality. After field evaluation, many mitigating measures have been designed into the roads to be built. Examples are closer culvert spacing, seeding cut and fill slopes, re-alignment to avoid high-risk areas, rock blankets and buttresses as special drainage structures, flatter cut and fill slopes, and changing alignment to reduce cut and fill slopes. (Chapter II - Alternatives Considered In Detail, Resource Impacts, Mitigation, and Enhancement).

"Perhaps more helicopter logging could be planned to avoid roading sensitive areas. For those roads that are built, extraordinary measures are possible and warranted -- even at increased cost."

The amount of helicopter yarding has been reevaluated to avoid roading sensitive areas. Field reconnaissance of road locations has resulted in deleting several roads which would have had significant environmental impacts. This is a change from the DEIS and will be addressed in the Record of Decision.

"Harvest units 5264, 5270, 5420, 5422 and 2206 are on bare rock or shallow soil on very steep (70-100 percent) slopes directly along Hills Creek. Units 5264 and 5270 should not be harvested, and portions of the other three units near Hills Creek or on unstable soils should also remain unsalvaged to prevent accelerated erosion."

Harvest units 5264 and 5270 have been dropped from further consideration. The silvicultural prescription for the remaining harvest units are as follows: 5420, clearcut; 5422, partial cut; and 2206, shelterwood cut. This is a change from the DEIS and will be addressed in the Record of Decision. These three units will be skyline logged with partial suspension of logs while yarding. This harvest method will result in much less disturbance than the Regional Forest Service standards of not-greater-than 20 percent of the area left in a compacted, displaced, puddled, or nonproductive state from timber harvest. Mitigating measures, such as straw mulching or grass seeding and fertilizing, would be applied to areas where disturbance exceeds the standards or to minimize erosion. The boundaries of the harvest units along Hills Creek (5420, 5422, 2206) have been adjusted back away from the steep slopes along the stream. The harvest unit prescriptions have focused on the need for maintaining residual trees for root strength or shade for regeneration. Harvest area boundaries have been located to be sensitive to regeneration and slope stability needs.

We are concerned about broadcast burning of areas composed of unsuitable or highly erodible soils and/or high fire intensity because this would further deplete soil nutrients and damage soil.

There is concern regarding the potential loss of soil productivity. As a result, there will be minimal burning of slash everywhere within the fire area. Post-harvest fuel loading surveys will be done with an emphasis on leaving slash on areas previously scheduled for burning that need protection to assist in maintaining long-term site productivity. If burning is required, the main purpose would be to reduce the fuels, thus reducing the fire hazard (Chapter IV - Environmental Consequences, Geology and Soils, Effects Common To Alternatives B, C, D, and F).

> **"There is no mention of soil compaction in the DEIS. Compaction is inevitable during harvesting and should be considered for productivity."**

Tractor yarding will not be done due to the high potential for damage from soil compaction. Suspension requirements for the various harvesting activities were selected to minimize soil disturbance (soil displacement and compaction). A minor amount of soil compaction and displacement will result from the timber harvesting. The amount of soil compaction and disturbance resulting from timber harvest and road building activities should be well below the Regional Forest Service standards. Refer to Appendix G, Detailed Harvest Information, which displays harvest methods by alternative.

> **Harvesting of timber on unsuitable lands would result in a loss of forest habitat, soil erosion, and loss of long-term site productivity.**

In response to this concern we have recommended to the decision maker that harvest of unsuited land should be reduced. Unsuitable timber lands are defined in the glossary of the Shady Beach Fire Recovery Project DEIS, as lands not appropriate for timber production. Criteria used to define unsuitable timber lands include but are not limited to; soils that are shallow in depth, contain a high proportion of rock fragments (greater than 70 percent), and have a south aspect. Only dead trees will be harvested on lands classified as unsuitable. Any green trees expected to survive on unsuitable timber lands will be retained as a seed source. The recommendation to harvest unsuitable timber lands was based on timber utilization and economics (refer to Chapter IV - Vegetation, Effects Common to Alternatives B, C, D, and F). Raveling of rocks is expected to increase as a result of the wildfire but soil erosion should not be of any significance due to the rockiness of the sites. After the effects of the wildfire, loss of long-term productivity would be minimal due to the already low site quality. Salvage of dead trees would affect wildlife habitat and input of woody material to the organic matter component of the site.

> **I disagree with the F.S. claim that the "key" indicators for soil productivity are Total Organic Matter (T.O.M.) and Total Erosion. There has been no accounting for the loss of soil nutrients which would occur following harvest activities due to changes in micro-climates (soil temperature increases) which would result in an oxidation of much of the remaining organic matter.**

Analysis of soil productivity did not account for soil nutrient loss following harvest due to changes in micro-climates (soil temperature increases) or resulting oxidation of remaining organic matter. Currently there is no practical or reliable field-oriented methodology for assessing soil nutrient losses due to changes in micro-climates (soil temperature increases) or the resulting oxidation of remaining organic matter. The "key" indicators of total organic material (TOM) and total erosion were used as indicators for soil productivity because they are the only easily measurable or observable methods of predicting soil productivity that are available. The TOM concept is relatively new and still needs more testing and refinement. Neither method has the ability to provide absolute values. (Chapter IV - Environmental Consequences, Geology and Soils, Effects Common To Alternatives B, C, D, and F.)

SOILS

> **The F.S. needs to address more thoroughly the issue of soil disturbance caused by cable logging systems. The disturbed soil would be more susceptible to erosion and could result in patch removal of the A horizon on thin soils.**

Suspension requirements for cable and helicopter yarding were specified to minimize soil disturbance and any resulting soil erosion. Erosion rates by harvest method can be found in the Combined Erosion Rate Process Paper, Shady Beach Fire Recovery Project Analysis File, at the Rigdon Ranger District office, Oakridge, Oregon. Both local knowledge of past cable yarding practices and Soil Resource Inventory (SRI) information was used to select suspension requirements to minimize soil disturbance. Much less than 20 percent of the area is expected to be left in a disturbed condition (soil compaction, displacement, or nonproductive state) as directed by Regional Forest Service standards. Post-harvest watershed condition surveys will evaluate soil disturbance and susceptibility to erosion. Areas of soil disturbance determined to be susceptible to soil erosion will be mitigated by erosion-control grass seeding and fertilization and/or mulching with straw. (Chapter II - Alternatives Considered In Detail, Resource Impact Mitigation and Enhancement.)

> **"It is not clear how the fire area sustained a significant loss of organic material. Averages and totals...tend to distract us from those specific areas of critical concern."**
>
> **"Areas where the biomass capital is in obviously short supply deserve extraordinary measures to accelerate their recovery."**

Averages and total values of organic material were used to give an overall perspective. Specific information is available in the Shady Beach Fire Recovery Project Analysis File (Fuels Management-Total Organic Material and Soils) and Appendix A. Steps have been taken to minimize further reductions in already short supplies of the biomass capital by minimizing broadcast burning of harvest units. Post-harvest fuel loading surveys will be completed with an emphasis on leaving slash on areas previously scheduled for burning that need extra protection. Adding organic mulch, fertilizing, and planting of seedlings as soon after timber harvest as possible are prescribed mitigating measures which respond to the need to quickly build up the sites' organic material.

> **"Since many land types in the project area are classified as unstable, with historical evidence of slides and debris flows, especially along stream channels, the proposed road construction and harvesting of dead, damaged, and associated green trees would contribute to the increased risk of surface soil erosion and mass wasting events. Sediment yield and turbidity in the associated streams may seriously jeopardize fish habitat potential."**

Road construction and timber harvest are expected to increase the risk of localized mass failures and soil erosion. The increased potential for soil erosion and landslides will occur on; steep slopes as tree and shrub roots decay; along roads due to drainage problems; and from failures of road cut and fill slope failures. If the eroded material enters a stream channel, the result will be increases in suspended sediment and turbidity downstream (Appendix B, Hydrology and Chapter IV, Water and Fish). Negative impacts to fish habitat could occur due to the effects of increased sediment on spawning gravels if a mass failure were to directly enter a stream system. Best Management Practices, such as closer culvert spacing, seeding and fertilizing all cut and fill slopes, road re-alignment to avoid high-risk unstable areas, rock blankets and buttresses as special road drainage structures, flatter cut and fill slopes, changing road alignment to reduce cuts and fills in high risk unstable areas, organic mulching and/or seeding and fertilizing bare soil areas in harvest units and along streams, woody material input into streams, and an increased number and width of stream buffers will minimize the risk of increasing surface erosion and mass wasting events due to harvesting and road construction.

> **The various indices used to predict soil erosion should not be based solely on the total miles of road and acres of harvest. With proper design of a harvest and road system erosion rates, sedimentation, and mass wasting could be controlled. "The environmental effects of road building must be re-evaluated taking into account state-of-the-art mitigation measures. The predictions of soil erosion, mass wasting and stream sedimentation are excessively high."**

The soil erosion values have been re-evaluated and adjusted to reflect state-of-the-art mitigating measures to reduce total soil erosion from timber harvesting and road building. These new values are about 50 percent less than the values presented in the DEIS and these new values can be found in the FEIS - Chapter II, Comparison of Alternatives and Chapter IV, Geology and Soils sections. Reference to the assumptions used to determine the erosion values is stated in the Combined Erosion Rate Process Paper, Shady Beach Fire Recovery Project Analysis File (as referenced in Chapter IV) at the Rigdon Ranger District office, Oakridge, Oregon.

> **"The overall erosion values for the various alternatives seem extremely high in comparison to the erosion rates on Figure B-C-12 of the Willamette National Forest Plan...What assumptions were used when they were calculated? It is difficult to understand how an area that has been subject to a forest fire can have a significantly higher potential for erosion than a similar area that is subject to a 100% clearcut...on a steep slope with unstable soil."**

A revision in the method of calculating erosion rates was done to bring the predicted values more in line with the values found in the Proposed Forest Plan/DEIS. Information on specific predictions and assumptions of wildfire related impacts on erosion rates are presented in the Combined Erosion Rates Process Paper, Shady Beach Fire Recovery Project Analysis File, at the Rigdon Ranger District office, Oakridge, Oregon.

> **The DEIS suggested that the potential for logging debris flows entering Hills Creek Reservoir would be moderate in Alternative B while no mention of the potential is made for Alternative C. What does moderate potential mean? Why is there potential for debris flows when mitigation measures are in place.**

The difference in debris flow potential between Alternatives B and C is based on amounts of road construction, amounts of clearcut logging with removal of incidental green timber in sensitive areas, and in stream buffer prescription. This is displayed in Figures IV-4 and IV-5 in Chapter IV under Alternative B and Alternative C. The rating of "high risk" for Alternative B and "moderate risk" for Alternative C are "relative ratings" to compare alternatives, not predictions of actual magnitude of change or of specific events. Mitigation measures can be planned to avoid or reduce impacts but cannot guarantee prevention of significant mass-wasting events after road building, harvesting, or catastrophic fire.

WATER QUALITY/FISH

> **"Although there are some pre-fire data from the analysis area, the management team should strongly consider basin-wide monitoring of water temperature over the next several decades."**

A 5-year water-monitoring plan will be implemented and 14 stream-monitoring stations have been installed in the project area. These stations will monitor a variety of stream characteristics, including water temperature. Stream temperatures will be monitored at each site during the summer months when low flows and high incident solar radiation can be expected to result in relatively high water temperatures. For a detailed description of the water monitoring plan see the Hydrology Analysis File for the Shady Beach Fire Recovery Project at the Rigdon Ranger District office, Oakridge, Oregon.

> **"The temperature increases which will be produced by harvesting in the Hills Creek drainage are not acceptable, it is short sighted to believe that the decrease in ARP on those areas bordering streams will not also have a significant impact."**

No measurable increases in stream temperatures above State water quality standards are anticipated in any subdrainage within the analysis area as a result of harvest activities proposed under Alternatives C, D, or F. Harvest restrictions within stream management units along perennial streams (Classes I, II, and III) would protect both dead and live vegetation within these areas providing shade for streams. (Chapter IV - Environmental Consequences, Alternative C, Temperature.)

Reductions in ARP would have no effect upon stream temperatures as long as adequate buffers are retained or enhanced along permanent streams. ARP values are indicators only of relative increases in winter flows and should, in no case, be used to infer temperature changes.

> **"Because of the extent of the fire damage to vegetation throughout the analysis area, summertime water and land temperatures are already expected to increase significantly, due to lack of streamside shading. Increased temperatures will result in the loss of regenerating vegetation...Additional harvesting will only retard development of protective covering."**

Increases in summertime stream temperatures are anticipated where the fire removed significant amounts of shading vegetation, however, no measurable increases in stream temperature are expected due to harvest activities under Alternatives C, D, or F. Harvest restrictions would apply to riparian areas with perennial streams to protect shading vegetation. Several common riparian tree species will be planted along stream channels that received a moderate-to-high intensity burn to regenerate shading vegetation as quickly as possible. (Chapter II - Alternatives, Including the Proposed Action, Alternatives Considered In Detail, Resource Mitigation and Enhancement.)

Increased temperatures outside of riparian areas will not affect vegetation recovery but it may affect species composition of recovering vegetation. If high soil temperatures are expected to affect tree seedling survival, shading structures will be provided to protect the seedlings as described in the silviculture prescriptions contained in the Shady Beach Fire Recovery Analysis File at the Rigdon Ranger District office, Oakridge, Oregon.

"In some situations buffers are not even appropriate for temperature control because southerly flowing streams are protected only slightly from the mid-day sun by streamside vegetation, especially conifers."

The stream buffer requirements in Alternative C were designed to meet the standards and guidelines in the Proposed Forest Plan/DEIS. (Refer to Chapter II - Alternatives Including the Proposed Action, Alternatives Considered In Detail, Resource Impact Mitigation and Enhancement.) In addition to preventing stream temperature increases above post-fire conditions, the buffers within the stream management units were designed to be sufficiently wide to meet the following objectives:

1) reduce the amount of sediment reaching stream channels
2) protect channel stability
3) retain existing and future woody debris inputs
4) retain riparian ecosystem values for plant and animal species

Those streams which flow north and south will receive adequate shade. These streams are not very wide and riparian vegetation generally over-hangs the stream channel and midday, vertical sun exposure lasts for only a short time.

"The Forest's assumptions of stream temperature changes over time chose not to consider the recovery of streamside shade. This is a significant error since vegetation regrowth and recovery is already occurring. Furthermore, the Forest hypothetical recovery estimates in the DEIS displays a significantly slower recovery rate than those estimated by research conducted by Summers (1983) in Western Oregon."

A time function which estimates the percent shade recovery based on Summers (1983), as modified by Beschta and Taylor (1988), was used in the DEIS and FEIS to estimate stream shade recovery related to pre-fire management (FEIS - Appendix B, Modeling Stream Temperature Changes). This model was combined with pre- and post-fire field data collected within the analysis area to derive estimated stream temperatures in the analyzed subdrainages. Recovery of streamside vegetation was not considered to be significant during the first summer season after the fire.

"Cumulative effects are assessed largely on the basis of ARP, which in some of the subbasins is projected to be very low after salvage/harvest. ARP...should not be the sole parameter considered in cumulative effects predictions. Because ARP is considered over entire subbasins, it will not identify potential hazards in riparian areas from too much removal of LWD, stream cleanout, or other practices which can contribute significantly to downstream cumulative effects."

Cumulative effects for the watershed resource were assessed on much more than just ARP. Peak stream flows are significantly affected by ARP (FEIS - Appendix B, Aggregate Recovery Percentage), and consequently channel erosion, sediment yield and turbidity are affected by changes in ARP. However, the major factors that contribute to sediment yield in streams are surface soil erosion and landslides (refer to the Soil Erosion Process Paper, Shady Beach Fire Recovery Project Analysis File at the Rigdon Ranger District office, Oakridge, Oregon).

Concerning large woody debris, the stream buffers being left on all Class I, II, and III streams are designed to provide for current and future input of large woody debris.

"A comparison of the ARP charts for Alternative B...leads me to conclude that harvesting green trees to "...logical unit boundaries"...has a very significant impact on predicted ARP values for Tufti Creek and perhaps others." Approximately a 50 percent reduction from the post-fire baseline. "There seems to be little difference between Alternatives B and F despite the dramatically different themes."

The main reason for the dramatic changes in Tufti Creek ARP values for all alternatives is the large amount of privately owned land in this subwatershed. This land was harvested some years ago and was partially recovered hydrologically before it burned. The effect on the area is the same for all alternatives, since there is little that can be done in the short term to improve ARP values. It is also private land and beyond the control of the Willamette National Forest.

Of the fully analyzed alternatives, Alternative B has the greatest effect on ARP values. In Alternative B, the absolute reductions in ARP values would be 13.3 (the largest reduction) in the Modoc Creek subdrainage, 7.5 in the Tufti subdrainage, smaller reductions in most other subdrainages, and 4 percent for the entire project area. Implementation of Alternative F would reduce the ARP by 7.0 in the Tufti subdrainage and reduce the overall ARP for the project area by 2 percent. Reduction in ARP values of this magnitude are consistent with the themes of Alternatives B and F since both alternatives allow for the harvesting of green trees for logical harvest unit boundaries. (Refer to Chapter IV - Environmental Consequences, Water and Fish, Effects Common To Alternatives B, C, D, and F, Stream Flow Changes and ARP.)

The mitigation measures for Alternatives C, D, and F indicate a buffer only be established for Class IV streams where they are adjacent to areas of high mass wasting potential. I suggest that all streams with soils susceptible to mass wasting or debris flows (as determined by SRI) be given a minimum stream buffer of 100 feet.

In response to the many comments we received on the need for wider buffers, stream buffers in the FEIS have been increased to a width of 75 to 150 feet, depending upon the characteristics of a given stream. All streams which flow through soil types susceptible to mass wasting will have a minimum buffer of at least 100 feet. Soil Resource Inventory (SRI) data was used in combination with field reconnaissance to identify those areas with a high potential for mass wasting. A mass wasting event could be considered a debris flow when it has reached a stream channel. In these sensitive areas, there will be no timber harvesting for a minimum distance of 50 feet from the edge of a stream. (Refer to Chapter II - Alternatives Including the Proposed Action, Alternatives Considered In Detail, Resource Impact Mitigation and Enhancement.) Additional mitigating measures will be implemented on sensitive streams, including large woody debris placement, hardwood and conifer tree planting, and construction of erosion control structures.

"There is no systematic, basin-wide analysis of fish habitat (including large woody debris) and numbers. We strongly urge the project and the Forest to consider such a survey in the immediate future."

A basin-wide analysis of fish habitat was beyond the scope of the Shady Beach Project. A survey of fisheries and large woody debris was conducted in the project area after the fire to help identify potential fish habitat and watershed impacts. Basin-wide surveys are now being conducted on the Forest with completion expected in 2 years.

The Forest is contracting with the Oregon State University Stream Team to survey about 40 miles of stream this year. A copy of this contract is available for inspection at the Supervisor's Office of the Willamette National Forest, Eugene, Oregon. The first priority for survey is Fall Creek, second is the South Fork of the Santiam River, and third is the Middle Fork of the Willamette River above Hills Creek Dam. Next year another 40 to 60 miles will be surveyed on the Middle Fork. The Forest is waiting for Regional guidance regarding the riparian information to be gathered along with the in-stream data.

> **"The overall riparian guidelines state that hardwood species, such as willow will be planted along streams..." Other hardwoods should also be considered.**
>
> **"The constructive role of large woody debris (LWD) cannot be overstated. Along streams where the canopy has been removed, conifers as well as hardwoods should be planted to provide a future source of LWD."**

Although the DEIS specifically mentions willow as a species to be planted, it was not our intent to preclude other natives species from being utilized for riparian resource restoration projects. Other riparian species such as red alder, cottonwood, maple, and western redcedar may also be used, depending upon aspect, exposure, and natural plants communities in a given area. Reforestation of areas adjacent to riparian zones will also involve planting conifers in the riparian zone and these plantings will provide future sources of long-lasting large woody debris. This has been clarified in the FEIS; refer to Chapter II - Alternatives Including the Proposed Action, Alternatives Considered In Detail, Resource Impact Mitigation and Enhancement.

> **"A 100 foot no-cut buffer is recommended for all streams....Water quality standards are already exceeded in many of the subdrainages and should not be pushed further by excessive cutting."**
>
> **"Implementation of Alternative C would retain no buffer areas adjacent to class IV streams, resulting in high disturbance to these areas."**
>
> **We are concerned with plans to clearcut within 100 feet of class II and III streams within the burn area.....If anything, the buffer zone around riparian areas should be extended rather than curtailed."**
>
> **"Given the importance of Large Woody Debris...recognized throughout the DEIS, the SMU no-salvage buffers recommended for class I, II and III streams will be too narrow. Salvaging dead timber from the outer 25-50 feet of the 100 foot SMU will result in deficiencies in the Large Woody Debris loading over both long- and short-term."**
>
> **In planning Streamside Management Units, Forest Service specialists should have the widest possible latitude to employ protective and mitigating measures, unencumbered by other considerations and limitations. On some sites buffers adjacent to areas of moderate and high landslide potential may benefit from and should be afforded widths much greater than 100 feet. Equally liberal standards should be applied to class IV streams.**

Since there was substantial public concern expressed for better protection of riparian areas than was originally presented in the DEIS, we have decided that wider streamside buffers would be implemented as described in Chapter II - Alternatives Considered In Detail, Resource Mitigation and Enhancement. Buffers on Class I, II, and III streams will now generally be 75 to 150 feet wide on each side of the stream, depending on topographic features or floodplain width. Buffers will also be left on several more Class IV streams. Where buffers are left on Class IV streams, they will generally coincide with topographic breaks associated with the stream channel and buffer width, and will be variable. Buffers will be marked during sale lay-out and retention of these buffers will be monitored prior to, during, and after harvest. (Refer to Chapter II - Alternatives Including the Proposed Action, Alternatives Considered In Detail, Resource Impact Mitigation and Enhancement.)

> **"...The general analysis needs to be taken one step further by merging the subbasin information into a landscape perspective. The Shady Beach Team needs to consider the desired future condition of the riparian areas before plotting their management."**

The desired future condition for riparian areas as reflected in the Proposed Forest Plan/DEIS (Section B - Specific Standards/Guidelines) is for all Class I, II, and III riparian areas to be 75 to 150-feet wide on each side of the stream with no less than 90 percent of their area to be in a fully recovered condition. This direction was followed when developing riparian management prescriptions for this project.

> **"Readers are led to believe that the riparian areas under (Alternative) B will be stripped of any timber and vegetation, while C appears to protect the riparian area." Would not both alternatives be required to meet State Forest Practices Act regulations?**

Alternative B does meet State Forest Practices Act regulations, but the stream protection measures called for under that legislation are of lower standard than is required by Federal legislation and Forest Service policy. Alternative C incorporates stricter riparian protective measures than are prescribed by the Current Forest Plan/FEIS and specifies that no logging shall occur within 75 to 150 feet of all Class I, II, and III streams. Alternative B followed riparian guidelines in the Current Forest Plan/FEIS which prescribes that 75 percent of merchantable volume be removed from all riparian buffers. Thus, in Alternative B, only 25 percent of the volume would be retained in buffers. Some portion of those trees would likely sustain damage to their canopies during logging. The quality of riparian habitat is affected by the amount of large woody debris, standing snags, live broken-topped trees, and moderate microclimate afforded by the forest canopy. It is expected that removal of 75 percent of the volume would affect riparian habitat significantly and that retention of 100 percent of the volume would retain riparian habitat quality.

> **"The discussion of the salvage operations in riparian habitat must be explained better." Will salvage and subsequent reforestation actually increase the recovery period of riparian vegetation?**

Many riparian species depend on the cool, moist, microclimate provided by the canopy of trees branches, leaves, and needles during the summer, and the temperature moderation afforded by the conifer canopy in the winter. Salvage activity within the riparian zone will create openings in the canopy by actual removal of trees and by damaging the crowns of adjacent trees during harvest. Thus, the period of time required for canopy closure would be longer in a buffer that has been salvaged than in one which has not. Large down logs are also an important structural component of riparian habitat, as a source of cover, as a contributor to the micro-environment, and as a food base resource for many species of small mammals, birds, amphibians, and fish. The amount of large woody material available in a riparian system would be limited by management practices, which allow the removal of 75 percent of the tree volume. If little or no source for large woody material is left in a riparian area, additional large woody material would not be available for 175 to 250 years depending on the site conditions. Hence, harvesting in riparian areas lengthens the time required for all riparian vegetation functions to recover. Refer to Chapter IV - Environmental Consequences, Wildlife, Effects Common To All Alternatives, Riparian Dependent Species for a more complete explanation of riparian components.

> **"A problem with this analysis is the assumption that the only good habitat for fish is pools. While pools are certainly important ....they do not necessarily provide the critical areas necessary for rearing fry or young trout. The project should avoid attempts to be overly quantitative by translating large woody debris inputs to pool density to fish abundances."**

It was not our intent to imply that pools are the only good habitat for fish. Streams within the project area have an abundant riffle and cascade habitat component and pool habitat appears to be the limiting structural feature. Side channels and backwater habitat which provides rearing and winter resting habitat along Hills Creek are also not present within the area due to the confined nature of the channel. Large woody debris certainly affects pool formation, but it is also responsible for the formation of backwater areas and side channels that are important to the rearing of young fish. Large woody debris, whether forming a pool or in a riffle section of the stream, also provides places for juvenile fish to hide. For these reasons we feel that our reliance on the level of large woody debris in the stream system as an important index to fish habitat quality is appropriate. (Chapter IV - Environmental Consequences, Wildlife, Effects Common To All Alternatives, Riparian Dependent Species.)

> **Within the DEIS, relatively little mention is made of what species or stocks of fish occur within the project area. Statements are limited to mention of species that occur in the reservoir and in the "stream system". No information is provided on what occurs where or even data on relative abundances.**

No specific information was given on species locations in streams within the project area in the Water and Fish section of Chapter III. All fish-bearing streams in ht eproject area contain the same set of game and non-game species. However, this portion of Chapter III does list the species to be found in the stream system and in Hills Creek Reservoir. Though these streams have all been sampled to determine the presence of fish, this sampling was not done intensively enough to give an accurate measurement of abundances.

> **"The Forest spent a significant effort analyzing predicted effects but gave little forethought to fishery restoration and enhancement projects. Several projects that could mitigate negative effects of fire and salvage include use of plywood over streams to reduce solar radiation and slow the warming of water temperatures."**

Several mitigation and enhancement projects were mentioned in the DEIS Chapter II - Resource Impact Mitigation and Enhancement. These include retention of no-cut buffers along all perennial streams as the most effective way to prevent solar heating, for recruitment of large woody debris, and to provide a food base. In addition, planting of various species along the channel and placement of debris in the channel where structural habitat is lacking will be done.

Placement of plywood structures to reduce solar heating of streams was not considered as a reasonable mitigation/enhancement measure for several reasons: 1) Trout are sight feeders and would not be able to forage effectively in streams covered with plywood; 2) The food chain which riparian species depend upon is based on algae and other aquatic plants which would not grow in the dense shade provided by a piece of plywood; 3) A variety of riparian species require standing live trees, dead trees and down logs and these logs also provide for moisture retention, long-term nutrient reserves, and serve as sediment traps; 4) Plywood could hinder the movement of large animals that use riparian areas and 5) This method of reducing stream temperature would be extremely expensive to install and maintain. Riparian buffers, whether trees are dead or alive, serve many more functions than simply shading a stream.

WATER QUALITY/FISH

It is not correct to claim that sediment or turbidity will not measurably affect fish or anglers in streams or Hills Creek Reservoir; such impacts might well occur and be measurable.

Our intent was not to imply that turbidity would not affect fish and anglers. We estimate that the increase in turbidity of Hills Creek or Hills Creek Reservoir as a whole will not be large enough to measurably affect angling or fish numbers. In view of the small percentage of total volume of flow contributed by the project area to Hills Creek, and in view of the existing high turbidity in Hills Creek Reservoir, the added turbidity may not be significant in terms of affecting the fishing in these areas. Turbidity in tributary streams may affect fish, however. Turbidity increases may affect angling in the Hills Creek arm of the reservoir, but the effect will be short-term and will likely be insignificant to the reservoir as a whole. (Refer to Chapter IV - Environmental Consequences, Effects Common To Alternatives B, C, D, and F, Sediment Movement and Turbidity.)

In the definition of Large Woody Debris (LWD - in the glossary) there is no mention of minimum size, either diameter or length. Under "large woody material", (LWM) dimensions of at least 16 inches diameter on the large end and 40 cubic feet volume are given. We hope that this definition of LWM approaches that of LWD.

Large woody debris, as discussed in the text and as defined in the glossary, refers to functional large wood in the aquatic and riparian systems. This material consists of woody material sufficient in size to be stable and remain in the riparian area. The size requirements for this material vary with stream flow, but it should generally exceed 20 inches in diameter and be long enough to be stable in a given channel. Because of this variability, specific guidelines were not given in the text. Specific guidelines for the size of LWD to be retained in riparian areas can be found in "In-Stream Large Woody Debris Management Guide, USDA Forest Service - Willamette National Forest, Rigdon Ranger District" by Vanderhayden, which was cited in the text. (Refer to Chapter IV - Environmental Consequences, Effects Common To All Alternatives, Large Woody Debris.)

"Timber sale and related management activities could unlawfully violate constraints imposed by the Clean Water Act. In Oregon Natural Resources Council, No. 87-3737, (the Breitenbush Case; 9th Cir. Dec. 21,1987), the court held that timber operators must follow state and federal clean water, non-degradation standards. A permit must be granted by the State of Oregon, if any degradation is to be allowed, if first found to be unavoidable and necessary. Again, nothing in the DEIS fully satisfies our concerns that the agency is complying with the non-point pollution requirements of the Department of Environmental Quality in terms of unlawful increases in both turbidity and temperature, which potentially effect nearby water courses. "Best Management Practices" are not good enough if these basic standards are still being violated."

Our analysis of both erosion and temperature increases indicates that best management practices and occasional additional mitigation in sensitive or high-risk drainages will assure that State water quality standards are met and beneficial uses are protected. Mitigation will include planting of stabilizing vegetation and placement of woody debris in Class IV channels, retention and placement of large woody debris in permanent channels, and compliance monitoring. (Refer to Chapter II - Alternatives Including the Proposed Action, Alternatives Considered In Detail, Resource Impact Mitigation and Enhancement). These methods have been used and were found to be very effective on similar soils in the Layng Creek drainage on the Umpqua National Forest.

Additional monitoring is planned to assure the mitigation is implemented and to test its effectiveness. This plan has been approved by the Department of Environmental Quality.

> **"Additional information is needed to support the final EIS. This includes documentation for a water quality/fish monitoring plan....Also additional information is needed to understand how the project will comply with Oregon Water Quality Standards for turbidity. Our review has identified issues which may require changes to the preferred alternative or application of additional mitigating measures."**

A water-quality monitoring plan has been developed which emphasizes water-quality compliance and preservation of beneficial uses. Provisions also have been made to assure that the field mitigating measures are implemented as planned. This plan is referred to in Chapter II - Alternatives Considered In Detail, Monitoring and can be found in the Shady Beach Fire Recovery Project Analysis File for this project.

The turbidity model used in this analysis was intended to provide comparative information for the various subdrainages. The uncertainty in the model does not permit its use for measuring compliance with the State turbidity water quality standards. To avoid confusion, we have removed the turbidity analysis and will use the erosion analysis to identify critical watersheds. Compliance to the turbidity standard is expected through the use of "Best Management Practices" and special mitigative field practices, as described in the previous response. Past experience has proven these methods effective for similar soils and slope conditions.

Provisions have also been made for compliance monitoring to assure that all beneficial uses are protected.

> **"The post-fire, non-managed environment is the base line for our analysis. We believe that temperature and turbidity are two water quality parameters of concern for this DEIS... While some increase in temperature and turbidity may be allowed over post-fire, non-managed conditions, such increases shall not impact beneficial uses."**
>
> **"In addition to specific parameter standards, the water quality rules contain an anti-degradation policy (which) must be considered even if specific parameter standards are not to be exceeded."**

Experience with similar watersheds, such as the Layng Creek municiple watershed on the Umpqua National Forest, indicates that standards will be met and beneficial uses protected if USDA Forest Service Region 6 "Best Management Practices" are followed and appropriate additional mitigation is taken. (Refer to USDA Forest Service 1988g in the Literature Cited section.)

The water-quality monitoring plan provides for compliance testing to assure that State water quality standards are met. Beneficial uses will also be monitored to assure compliance with the anti-degradation policy.

> **Alternative C should be altered to prevent suspended sediment and turbidity from reaching the levels predicted in the DEIS. More frequent and wider stream buffers may alleviate this problem to some extent, but it is the concentration of cutting units in such a small area that is really the cause of the problem.**

In response to public comment, in the FEIS we have prescribed for wider stream buffers and more stabilizing activities in areas that could produce high amounts of sediment as described in

Chapter II - Alternatives Considered In Detail, Mitigation and Enhancement. Wider stream buffers and mitigation within riparian areas such as straw mulch, grass seeding, hardwood planting, and large woody debris placement will considerably reduce the short- and long-term potential of eroded material delivery to the stream system. The data presented in the FEIS will be used to identify sensitive subdrainages for implementation of additional mitigation. An extensive water monitoring plan will be implemented to insure that State water quality standards are being met and beneficial uses are preserved.

> **In relation to water quality and temperature, there is a great deal of current information that suggests the historic attitudes on temperature and fish habitat are not valid. Stream temperature used as a measure of stream health and fish productivity is inappropriate. Contrary to statements in the DEIS, recent research concludes that temperature is probably not the major concern with respect to fish mortality...With increased temperature, fisheries productivity has been shown to increase due to: increased activity, increased food supplies, and earlier development. These factors may offset any decreases in fish populations as a result of reduced habitat due to lethal temperatures, loss of pool habitat or loss of concealment and escapement cover from preditors.**

The references cited in this comment are contained in a publication called "Streamside Management (Forestry and Fisheries Interactions)", and is available through the University of Washington, Institute of Forest Resources. This is a reputable reference, however, this comment appears to present only one side of the picture. There is discussion in the cited document that both supports and disclaims the above point of view. The publication provides information on studies that have yielded different results, in different areas, or under different conditions. The publication cautions against broad generalizations and encourages using caution in applying information that suggests beneficial effects of timber management on fish.

It is commonly known that some species may benefit from certain environmental changes (within specific ranges) while other species may be adversely affected by the same changes. Thus it is important to keep in mind the natural condition of an area and the plant and animal communities which have evolved adaptations for that natural condition. It is also important to keep in mind the range of temperatures in which studies are conducted. Often species may show a tolerance or an improved condition with an environmental change up to a threshold level, beyond which the reaction is intolerance or a degraded condition. Growth and activity of salmonids may be enhanced as temperature is increased within a temperature range below optimum temperatures (46 and 56 degrees Fahrenheit (F). However, the trend is reversed when temperature exceeds the optimum temperature of 58 degrees F. It would be taking scientific information out of context to imply that the improved performance demonstrated between 46 and 56 degrees F should be taken as an indication of expectations as temperature is increased between 58 and 74 degrees F.

It is well known and accepted by fisheries biologists that a temperature of approximately 58 degrees F is a threshold point at which vigor and productivity of salmonids is optimal. Performance improves as water temperature approaches that point, but performance drops as temperature increases beyond that point. The above reference states, "Except when fish are starving, the response of growth and activity to increasing temperature is enhancement up to some optimum temperature and then diminution as the optimum is exceeded."

Refer to the Water and Fish section of Chapter IV for specific information on which streams in the project area have predicted average August temperatures already exceeding the 58 degrees F threshold. Since these predictions are for average maximum temperatures it is not unreasonable to expect that higher than average maximum temperatures will occur. Stream temperature is not a major concern given average weather conditions in some drainages within the project area, but it is in others.

> **Sedimentation and turbidity as a result of harvesting and road construction would seriously jeopardize the possibility for fish species to recover to pre-fire levels. Degradation of fish habitat can be expected with the increased debris and silt delivered from the affected watershed.**

It is recognized that accelerated sedimentation and turbidity is detrimental to water quality and fish habitat. Mitigation measures have been prescribed to prevent excessive sediment delivery to streams in the project area. It is also recognized that small, unstable slash can create risks of debris flows where as large, stable woody material (logs) is beneficial to stream channel stability and quality of fish habitat. For these reasons, among others, no-harvest buffers are prescribed along all Class I, II, and III tributaries. These buffers will protect against excessive slash accumulation and will ensure future provision of beneficial large woody debris in streams. (Refer to Chapter II - Alternatives Including the Proposed Action, Alternatives Considered In Detail, Resource Impact Mitigation and Enhancement.)

VEGETATION

> **A number of ecoplots are established in the Shady Beach burn area, and will be monitored for some time. The monitoring plan should be made a part of the EIS.**

A comprehensive vegetation monitoring plan has been developed for the Project area, and is part of the Shady Beach Fire Recovery Project Analysis File at the Rigdon Ranger District office, Oakridge, Oregon. Permanent monitoring sites are established for the long-term study of fire effects on the plant associations of this portion of the Forest. The plan outlines methodology, responsibilities, and schedules. (Chapter II - Monitoring, Monitoring Activities Common to All Alternatives.)

> **Steps should be taken to permanently mark the boundaries of the permanent plots so disturbance does not inadvertently occur.**

Plot centers and boundaries have been well marked on the ground. Plot centers are marked with rebar (metal post). Buffers around each permanent plot have been established and permanently marked with flagging and tags to exclude them from timber sales. (Chapter II - Resource Impact Mitigation and Enhancement, Mitigations and Enhancements Common to Alternatives B, C, D, and F.)

> **"Data should be gathered from these plots until such time as a qualified ecologist determines that the areas have reached equilibrium and that no further successional changes are taking place".**

The plots will provide a photographic and documented record of change, over time. All monitoring sites will be in place by summer, 1989. Vegetation monitoring sites will be revisited each year for the first five growing seasons, and every 5 years thereafter. Plots will be monitored for 50 to 100 years, depending on the rate of vegetation recovery and successional trends observed, over time. (Shady Beach Vegetation Monitoring Plan, 1989)

> **"The National Forest Management Act (NFMA) instructs the Forest Service to take the natural diversity of a site into account in planning its stewardship activities". We feel the Forest Service should have added a seventh umbrella issue to address plant communities. Why was this not done?**

The six key issues were derived from our scoping process, which involved several public meetings and written comments. Although concerns were expressed for plant diversity, we felt we could adequately address them through other issues; particularly wildlife and water quality. By providing corridors and protecting and enhancing riparian areas, we maintain or enhance structure and composition of plant communities.

"Apparently no consideration has been given to the natural processes in the establishment of some of the plant associations of the area. Fire is a natural ingredient in the construction of the Douglas-fir plant associations". How can you maintain diversity, yet harvest at the proposed level?

Most of the area on which the fire occurred is considered General Forest according to current direction and the Proposed Forest Plan/DEIS. Therefore, our alternatives propose salvage of dead and dying timber as one of the main objectives. Alternative E, No Action, would permit totally natural processes to occur. Seed collected for reforestation came from the same elevational and geographic zone as the areas to be planted. Our intent is to avoid creating a monoculture and to attain the highest level production possible.

Sensitive communities (cliffs, meadows, and wet areas) have been identified as likely to support unique plant communities. "These areas should be closely studied throughout one or more growing seasons and monitored for the presence of rare or uncommon plants". We ask that these sensitive communities be mapped and identified in the Final EIS, and specify protective measures.

Special habitat areas, such as cliffs, meadows, and wet areas, are potential habitat for threatened, endangered, and sensitive plants (T, E, & S), and will be surveyed before ground disturbance occurs.

Locations of special habitats are on file at the Rigdon Ranger District office and can be reviewed upon request. It is our policy not to publish specific locations of T, E, & S plants in public documents.

Without mitigation measures, logging activities could have an adverse effect on special habitats. These potential effects will be largely avoided by the mitigating measures described for special habitat in Chapter II - Resource Impact Mitigation and Enhancement, Mitigations and Enhancements Common to Alternatives B, C, D, and F. Included are shifting road locations; directional felling away from special habitat areas; full log suspension; and retention of buffers around areas that contain sensitive plants. Other mitigating measures, to be determined at a later date based upon the needs of specific plant populations to be protected, would be implemented if surveys identify populations of sensitive species. Project monitoring will identify populations that could be affected by salvage activities.

"Many ecologists predict that there may be a slow and difficult "migration" northward of more southerly sorts of forest communities...The dry-slope old growth communities, such as those at Shady Beach, may very well prove to be of utmost importance in long-term forest survival in western Oregon. Thus, any management plan for the area should include written plans to protect these communities".

We estimate about 20 percent of the fire area consists of dry-slope, old-growth communities. This area is along the west side of the fire, near Hills Creek Reservoir, and will receive substantial protection through wildlife corridors and maintenance of visual quality objectives.

We agree with the potential future value of these types of forest communities but the fire has not eliminated this genetic resource. Many trees remain alive that can provide seed for future reforestation efforts. Moreover, seed collected from the area is on hand and will be used for reforestation stock.

Non-native grasses may compete with native and rare plants, and tree seedlings.

Areas seeded by exotic grass species may be dominant the first season, depending on the germination success. By the second growing season, native pioneer and secondary successional species will become established, sharing dominance with the exotic species. (Chapter IV - Vegetation, Effects Common to All Alternatives). Experience with planting grasses in similar areas on the Willamette National Forest has shown that non-native grasses will not have a detrimental effect on sensitive plant species

Grass establishment will compete with tree seedlings on some sites. Special site preparation measures, such as mulching, may be necessary to minimize effects of grass on dry, south aspects.

We ask that the Forest Service add the following species to the list of special plants to be watched for in the Shady Beach area: Cimicifuga Elata, Montia Diffusa, Botrychium Virginianum, Pityopus Californicus, Lycopodium Annotinum.

The USDA Forest Service Region 6 Sensitive Plant List is published yearly, and is based on the Oregon list of T, E, & S species. Three of the above species are already on the Region 6 list: Cimicifuga Elata, Montia Diffusa, and Lycopodium Annotinum. The other species, although not officially on our list, would occur on sites where we will be surveying for listed plants. We will watch for them. (Chapter III - Vegetation; Threatened, Endangered, and Sensitive Plants)

We request that rare plant surveys be done by qualified botanists before these areas are disturbed by road construction or harvest activities. How will this be done?

Although no T, E, & S plants have been found in the area in the past, surveys were conducted in the spring of 1989. They will also be conducted in the summer of 1989. Forest Service personnel who are trained in the identification of plants (including some who are members of the Native Plant Society) will field check potential habitats for the occurrence of plants. If plants are found, mitigation measures will be taken to assure management activities will not jeopardize the plants' existence or modify their essential habitat. Our intent is to survey potential habitats before permitting ground disturbance. In addition, contract specifications will stipulate that if plants are found during logging operations, mitigation measures will be initiated immediately. (Chapter IV - Vegetation, Effects Common to All Alternatives).

TIMBER

"We noticed that in all of the alternatives, varying amounts of acreage classed as unsuitable for reforestation are being proposed for salvage/harvest. We question the wisdom of such practices."

Salvage operations were proposed on unsuitable lands experiencing 100 percent mortality to recover timber volume which would otherwise be lost. The proposal was based on utilization allowed after catastrophic events and economic concerns. Justification for harvesting mortality on unsuited lands is given in Chapter IV - Environmental Consequences, Vegetation, Effects Common To Alternatives B, C, D, and F. Undoubtedly, leaving this mortality would provide wildlife habitat and would contribute to the long-term site productivity. Green trees expected to survive on unsuitable soils are prescribed to be retained as a potential seed source. The majority of the unsuitable soils are located on the southeast face of Cougar Mountain. We have proposed a cooperative study with the Pacific Northwest Experiment Station designed to analyze the feasibility (in terms of reforestation success) of harvesting on an unsuitable land base. The Record Of Decision will contain a final determination of how much unsuitable land will be harvested.

"The DEIS assumes an average site index of 130 for all Alternatives." The actual range of site qualities is not addressed in the Draft plan.

An average site index of 130 (McArdle) was indicated to provide a basis for growth projections. The actual range of site indices represented within the fire area spans 115 to 145 (McArdle). Climax plant associations include the Douglas-fir, grand fir, and western hemlock series (Plant Association and Management Guide, Willamette National Forest, Hemstrom and others, 1987). More information on the rationale for selection of this site index can be found in the silviculture prescriptions contained in the Shady Beach Fire Recovery Project Analysis File at the Rigdon Ranger District office, Oakridge, Oregon.

"References to wood deterioration in Appendix C only address decay in Douglas-fir. Stands with a substantial amount of grand fir should be high priority for early salvage."

Harvest unit prioritization from a volume recovery standpoint will be based upon the following variables:

1) Percent of unit acres with 100 percent outright mortality as opposed to predicted mortality.
2) Percentage of whitewood (i.e., grand fir and western hemlock).
3) Size class of salvage timber
4) Volume/Acre
5) Acreage
6) Desire to delay harvest to allow predicted mortality time to express itself (on unsuitable sites, units within low volume per acre).

Refer to Appendix C, Factors Affecting Deterioration Rate, for more information.

In the interest of maintaining a natural stand composition, are you using different tree species in your reforestation efforts? "We support the current strategy..of interplanting Sugar Pine with Douglas-fir on south aspects."

Reforestation prescriptions are designed to reflect the species diversity representative of the site prior to the fire. Specific unit stock allocations will be based upon plant associations and past reforestation success within the analysis area as described in Chapter IV - Environmental Consequences, Vegetation, Effects Common To All Alternatives. Species presently identified to be planted include Douglas-fir, ponderosa pine, sugar pine, incense cedar, western redcedar, and grand fir.

"The Forest Service should not be cutting everything on many of the clearcuts, but rather...leave smaller trees".. This would reduce the need to burn residue, and may reduce the potential for wildfire.

The understory smaller trees have thin bark, smaller crowns and are generally less vigorous as a result of occupying inferior crown positions. These characteristics predispose the smaller diameter trees to detrimental fire effects. Generally, ground fires burning vigorously enough to encircle the base of the smaller trees were sufficient to kill them. Therefore, in stands where the fire intensity and duration resulted in mortality of the larger, dominant trees, the smaller trees did not survive. If residual green tree stocking estimates following the fire were projected to under-utilize the potential of the site to grow trees, the preferred silvicultural treatment was to regenerate the stand.

Retention of standing dead, small-diameter trees would not reduce the need to burn residue or reduce the potential for wildfire. Over time, standing dead trees will succumb to natural decay and add to the harvest activity fuel loading. Eventually, fuel loading could increase sufficiently to cause a high intensity fire if ignited.

"Appendix C discusses the potential, based upon historical events, for insect buildups. However, analysis of the probability and consequences of such buildups...is totally lacking."

As discussed in Appendix C, Insect Activity Following Fire, there is a potential for the population increase of several species of cambium and wood boring insects. The probability and consequences of insect population buildups are not easily quantified, although Appendix C gives a historical perspective on insect damage. Inherent biological variation of insect population dynamics does not lend itself well to statistical inference.

We are concerned that the Forest Service volume estimates are too high. "Timber sales..must be based on actual cruises of predesignated timber, not estimates based on proposed silvicultural prescriptions."

Volume estimates for the FEIS were developed from a composite of field data, mature and over-mature stand data, McArdle yield tables, aerial photo mensuration tables, and comparative cruises from past sales in or near the analysis area. Estimated volumes were intended to provide a basis for feasibility analysis. They were not intended to be firm timber sale volumes. Actual timber sale offerings will be based upon cruises. Appendix C, Volume Determination, contains more information on how volume estimates were made.

These sales will be cruised prior to appraisal and the volumes will be presented in the Record of Decision. Sell volumes will be much more accurate than volume estimates contained in the FEIS.

Reforestation should begin immediately to get land back into production and enhance wildlife, and water quality.

Reforestation efforts have already begun on the harsh aspects of burned plantations within the fire area. The 1,795 acres of fire-damaged plantations were prioritized to outplant the limited available stock for the 1989 winter tree-planting contract. Additional stock has been requested to plant the remaining fire-damaged plantation area in the winter of 1990. Units in which competitive vegetation was expected and sites which have historically been difficult to reforest received a high priority for planting this season.

"The Forest Service should not be harvesting such a high percentage of green timber in an area that has been subject to such a catastrophic event as the fire."

In order to maintain the long-term biological potential of an area, in terms of timber volume and growth potential, understocked sites should be converted to fast-growing, thrifty plantations. Understocking is a quantitative measure of tree density, expressed in relation to the ideal or most effective number of trees which can effectively occupy a site (normal stocking). Retaining standing volumes at densities less than 60 percent of normal would result in an underutilized site. Therefore, if residual stand densities following the fire were estimated to be below 60 percent of normal, the stands were prescribed to be harvested and converted to plantations to more effectively utilize the site's potential.

Additional incidental green trees are included in areas to be harvested when inclusion of such timber was necessary to facilitate logging feasibility or to prevent future young plantations from being damaged by the need to yard through them to access mature stands that were isolated from the transportation system. The Glossary in the FEIS now contains definitions for Incidental Green and Logical Unit Boundary that further clarify this question.

The analysis underestimates the amount of old growth interspersed in young stands. When these areas are cut, the old growth is also cut and unaccounted for. Why can't these trees be left in the stands?

For this analysis, stands greater than 200 years of age with two or three canopy layers and less-than-20 percent predicted mortality in the upper crown layers, were considered to retain old growth characteristics. These stands received a partial cut prescription under Alternative C. Harvest will be confined to salvaging only the dead timber. Old-growth stand characteristics were destroyed in stands where the upper canopy mortality exceeded 20 percent. However, green wildlife replacement trees, where existing, will be retained at a rate of 1.8 trees per acre. Desirable wildlife trees exhibit "old-growth" characteristics, such as broken tops, large horizontal branching, irregular crowns, and evidence of pathogens. Retaining more than two trees per acre, but less than 60 percent of "normal", would result in sites being underutilized in terms of optimal growth on a per acre basis. Such stands should be harvested and converted to plantations to more effectively utilize the sites potential. Refer to Appendix C - Minimum Residual Stocking Levels, for a complete discussion.

"The Forest Service needs to be less liberal in its determination of what is imminent mortality. There is little doubt that many of the trees which suffered damage to the cambium layers...would actually survive if left undisturbed."

Mortality predictions were based upon research conducted by the USDA Forest Service, Intermountain Fire Sciences Laboratory, Missoula, MT.; Pacific Southwest Experiment Station, Redding, California; and the Forest Residues Program, Seattle, Washington.

The interaction of fire behavior (as influenced by aspect, slope, continuity, and size class of fuel loading, and pre-fire duff and soil moisture content), the thickness and insulating properties of the bark, crown condition and pre-fire tree vigor influenced predicted mortality. According to research, individual trees were considered poor candidates for survival if greater than one-quarter of the circumference of the tree was girdled at stump height and there was associated root damage. For purposes of quantifying mortality on the Shady Beach Fire Recovery Project, 50 percent and greater circumference mortality with associated root damage were minimum standards to consider the tree as a poor candidate for survival. Additional factors such as pre-fire stress indicators (i.e. crown length, crown position, tree vigor, evidence of pathogens, and site conditions) further refined mortality predictions.

> **"There are no provisions for monitoring insect activity. This is a serious oversight, especially if the reduced or no harvest alternatives are selected."**

In a study examining the relationship of bark beetle attack and fire injury, Furniss (1965) indicated that the trees most susceptible to attack by Douglas-fir bark beetles were those with moderate to heavy cambium damage. He found that Douglas-fir trees which experienced outright mortality as a result of fire injury were not attractive to Douglas-fir bark beetles. Harvest of favorable beetle breeding habitat (windthrow and severely scorched timber) is identified to be removed under the Forest Service Preferred Alternative C as described in the FEIS. (Chapter II - Alternative Considered In Detail, Alternative Descriptions, Alternative C)

A series of five infrared aerial photograph flights have been scheduled to monitor the progression of mortality. The fire area will be closely monitored over the next few years. If any insect epidemics occur, appropriate remedial action will take place immediately.

> **"Nowhere is data presented on fire intensity and the resultant post-fire condition of stands or riparian areas, even for the individual subbasins. This type of landscape level information is crucial."**

In response to this comment, a map of fire intensity was added to the FEIS in Chapter III (Figure III-3 - Fire Intensity Derived From Predicted Mortality). Fire intensity as reflected by mortality of vegetation was inventoried during the data collection phase of silvicultural prescription development (see data inventory form Appendix C, Figure C-2). Pre-fire and post-fire stand level attributes, including species composition, size class, stocking level, age/vigor and volume were developed by canopy layer. Completed inventory forms are on file and available for review in the Shady Beach Fire Recovery Project Analysis File at the Rigdon Ranger District office, Oakridge, Oregon.

> **Helicopter logging provides an opportunity to be very selective in the removal of timber, resulting in "excellent wildlife tree retention, and near zero impact on water quality."**

Varying levels of helicopter yarding are proposed under each of the fully analyzed alternatives in the FEIS. In addition to wildlife tree retention and water quality concerns, the decision to helicopter yard logs was based on a variety of concerns including visual impacts associated with roads, problems associated with road access, and economics. The model used for analysis did not show a significant difference between cable and helicopter yarding systems on predicted soil erosion rates. These predicted erosion rates would have a direct effect on water quality and were based on research and erosion rates as stated in the Proposed Forest Plan/DEIS.

Your re-analysis of Alternative C more efficiently uses existing and proposed road systems. How would other alternatives' road systems change as a result of this re-analysis?

Each alternative stands on its own and represents a specific strategy to access those portions of the fire area not accessible by the existing transportation system. Though some minor modifications were made to several alternatives, a re-analysis of effects was not done due to our perception that these small modifications have had no significant effect on the outcome of the alternatives. The modifications made to Alternative C have not affected the access strategies represented by the other alternatives.

FIRE/FUELS

> **The DEIS indicates broadcast burning is planned for most of the clearcut units. You should consider the effects of burning on large woody material and site productivity. Are there opportunities to avoid prescribed burning and still accomplish hazard reduction and site preparation objectives?**

In the FEIS, broadcast burning is planned for about 30 percent of the clearcut units. However, post-harvest site surveys will determine if hazard reduction is needed. It is difficult to accurately predict the post-harvest fire hazard potential of fuels resulting from salvage activities. Reduction of fuels will be necessary in some areas to reduce the potential of future catastrophic wildfire.

The effect of burning on large woody material has been considered in calculating the effects on large woody material and site productivity presented in the FEIS - Chapter II, Alternatives Considered In Detail, Comparison Of Alternatives and Chapter IV, Geology and Soils. The primary goal of hazard reduction is to remove the fine fuels (3 inches in diameter and less). Burning prescriptions will be developed to remove only the hazardous fine fuels. Large woody material may be retained by burning in the spring when the warmer weather has dried only the fine fuels, leaving larger fuels too moist to burn. The large woody debris remaining on site will decompose, over time, adding nutrients to the soil and thereby contributing to long-term site productivity.

Several alternatives to broadcast burning are planned, including but not limited to: 1) Extra protection: increasing fire patrols in hazard slash areas during periods of high fire danger. 2) Spot and strip burning: burning only concentrations of slash, not the entire unit. 3) Hand piling: hand piling hazard slash along roads and not treating the remainder of the unit. 4) Fuel breaks: utilizing natural and created barriers which limit the spread of wildfires. 5) Road closures: closing roads which will reduce the possibility of human-caused ignitions.

> **"Standing snags would have a significant impact on fire behavior for over twenty years". For alternatives D, E, and F the DEIS does not address the significance of snags on the risk of lightning ignition and the spread of fire, independent of the surface fuels.**

Current technology is not available to predict precisely the change an increase in snag density would have on the number of lightning ignitions or the spread of fires. Experience would indicate that an increase in the snag density would increase the probability of lightning ignitions and increase suppression difficulties. Alternatives C and D would have similar ignition potentials and suppression difficulties, Alternative F would have a greater potential, and Alternative E the greatest increase in potential.

Burning snags present suppression difficulties by showering burning embers across fire lines and starting spot fires. They also represent an extreme hazard to fire fighting personnel when attempting to fell burning snags. When snags burn through, the direction of fall is unpredictable.

Broadcast burning of a large number of harvest units near Oakridge may be necessary. How will you schedule burning and still meet standards for air quality?

Prescribed burning for hazard reduction will follow the guidelines established in the Oregon Smoke Management Plan. The Oregon Department of Forestry restricts slash burning to periods when burning activity will not impact designated smoke sensitive areas such as Eugene, Bend, and nearby wilderness areas. By following this process, air quality standards in Oakridge should be met.

Burning of harvest units near Oakridge may not be accomplished within planned timelines as burning conditions are dependent upon the weather. Prescribed burning activities may be delayed for a year or more while waiting for the right weather "window" (weather conditions which allow burning without affecting air quality in Oakridge).

The DEIS does not adequately address Oregon State standards for protection of air quality. What are they?

Air quality standards are set forth in the Clean Air Act (U.S. Congress 1977) and administered through the Oregon State Implementation Plan (SIP). The Clean Air Act requires states to meet National Ambient Air Quality Standards and "In the case of sulfur dioxide and particulate matter, each SIP shall contain measures assuring that maximum allowable increases over baseline concentrations of, and maximum allowable concentrations of, such pollutants shall not be exceeded."

The purpose of the Oregon Smoke Management Plan (SMP) is to minimize visual and health effects in areas designated by the State as smoke sensitive. Language within the SMP states that "The Department of Environmental Quality, in cooperation with the State Forester, Federal Land Managers, and private forest landowners, shall develop maximum annual and daily emission limits in accordance with federal Prevention of Significant Deterioration (PSD) regulations." The Oregon State Department of Forestry regulates the burning of residues to meet guidelines established in the SMP.

The specifics of the SMP guidelines are technical and a copy may be obtained through most Oregon State Department of Forestry Offices.

WILDLIFE

There should be no removal of habitat in the Pileated Woodpecker Habitat Area in the Shady Gap area. This PWHA was severely burned, significantly affecting the suitability of this habitat. Salvage would further impact this habitat area as burned trees provide nesting and feeding sites for the woodpeckers.

The Proposed Forest Plan/DEIS prescribes that PWHAs contain at least 300 acres of suitable habitat. Of the 300 acres originally designated to be a PWHA, 200 acres remain as suitable habitat. The final version of this plan will relocate this PWHA so the prescribed amount of habitat is preserved. The 160 acres of pine marten habitat that coincides with the PWHA will remain designated in the Shady Gap area.

The Pine Martin Management Areas in the northwestern corner of the analysis area, south of Skipper Creek, and in the Shady Gap area should be retained. They would be slightly smaller but they still look viable.

The preferred alternative should include the same Pine Marten Habitat Area as provided in the DEIS Alternative F.

The pine marten habitat areas provided in Alternative F were being delineated when the Shady Beach fire occurred. As a result of the fire, most of these habitat areas were intentionally located outside the fire boundary to include unburned, suitable habitat with the exception of the Pine Martin Habitat Area at Shady Gap. These habitat areas will not be affected by any salvage activity.

The DEIS states that over half of the Pileated Woodpecker Habitat Area (PWHA) was burned by the fire. "Please explain why this area is being maintained as a viable PWHA."

Of the 300 acres originally designated as a PWHA, only 200 acres remain as suitable habitat. Since PWHAs also encompass a 160-acre pine marten management area, 160 acres will remain designated as such. The area will not be designated as a 300-acre PWHA.

"We are very concerned that the contractor....may not pay adequate attention to protection of wildlife trees..." How will you insure compliance on the ground?

Timber sale specifications include numerous measures to protect resources including wildlife trees. The standard contract clause C6.32 will specify the number and types of wildlife trees and down logs to be left. Contract clause C2.3 will apply a dollar penalty for not meeting the minimum number of prescribed trees and logs. In addition, a Project monitor position will be created to determine whether the objectives stated in the FEIS are being achieved, (Chapter II - Monitoring, Monitoring Activities Common to Alternatives B, C, D, and F).

"Permanent forage areas are needed throughout the District and especially in the project area." The excessive forage available for the first 7-10 years will be completely out of production in 20 years.

The emphasis in the Proposed Forest Plan/DEIS is to provide forage on a rotating basis as opposed to converting timber base land to permanent forage production. This method is intended to provide an even flow of forage from the Shady Beach fire area. As conifers begin to shade out forage plants, other areas will be harvested to provide forage.

> **"The DEIS concedes that the proposed harvest of associated green timber ...will disrupt recovery of wildlife and vegetation in the area."**

This is partially correct. Harvesting green timber in partially killed stands will result in an even-aged stand of conifers. Except for mature trees retained for wildlife habitat, these regenerated stands will lack the structurally diverse habitat typical of uneven-aged stands that would have resulted if associated green trees were retained. Recovery may possibly take longer without the shade of green trees, depending on the severity of the site. Generally speaking, the presence or lack of retained green trees would not increase the time it would take for a closed-canopy forest to develop.

The Forest Service recognizes that by harvesting associated green timber within harvest units and replacing these stands with even-aged plantations, the result will be less habitat and species diversity. These lands designated for harvest are allocated as general forest lands. Harvesting the understocked associated green timber along with the fire-killed trees is seen as the best way to maximize timber production on these lands.

> **"During Oregon Department of Fish and Wildlife's (ODFW) interdisciplinary planning process, there were four clearcut units identified wildlife forage enhancement...We strongly urge that this mitigation proposal be included in the final alternative."**
>
> **"We suggest that the preferred alternative be modified to... incorporate the establishment of quality big game forage plots to help offset the reductions in thermal cover."**

The FEIS incorporates such a study as described in Chapter II - Monitoring, Monitoring Activities Common To Alternatives B, C, D, and F. We have identified three habitat types (Douglas-fir, western hemlock, and grand fir) that are typical on the Rigdon Ranger District and the Forest where big-game forage enhancement is planned. Two forage study plots will be installed on each habitat type to provide quality forage and to evaluate the compatibility of conifer seedling survival and seeded forage. These study plots are approximately 24 acres each and are within the four units initially identified, plus two other units for a total of 144 acres.

Other than providing quality forage to help offset the reductions in thermal cover, we hope to identify, with the above study, a forage mixture that is compatible with acceptable conifer seedling survival and growth which can be used in other winter ranges on the Forest.

> **The former Bull Creek SOHA should be monitored closely to determine if this habitat will still be used by owls after the fire.**
>
> **We object to..."monitoring the Bull Creek SOHA after logging of old growth stands, effectively destroying the owl habitat."**

We are presently monitoring the Bull Creek area to determine if the area is occupied by spotted owls and if nesting is occurring as described in the FEIS Chapter II - Monitoring, Monitoring Activities Common To Alternatives B, C, D, and F. This area will be monitored for a minimum of 5 years.

WILDLIFE

"Consistent with our input to the Forest Plan DEIS...we request that you "sustain wildlife species at 60 percent of potential..." as a management goal."

For managing snag-dependent species, namely primary cavity nesters like woodpeckers, the DEIS considered the range of 20 percent in Alternative B, 40 percent in Alternative C, and 100 percent in Alternative F. The 20-percent level is considered the minimal viable population level. As a trade-off between timber harvest and maintaining a population of snag dependent species, management direction is to provide for a 40-percent population level in Alternative C.

"The entire Bull Creek spotted owl habitat area (SOHA) should be retained as long as monitoring indicates that spotted owls are utilizing the area. In addition, an alternative SOHA should be established in close proximity to the project area to serve as a replacement for the Bull Creek SOHA if it should ever become suitable for spotted owls."

The Bull Creek SOHA should be maintained in the SOHA network as it is estimated that this habitat could be suitable for owls again in 80 to 120 years. Salvaging in this area with the subsequent intensive timber management would result in this area never satisfying habitat standards again.

The Bull Creek SOHA presently does not meet current habitat guidelines. The network of SOHA's has been changed to accommodate another SOHA location which has suitable habitat and occupancy by spotted owls. The current network of SOHA's is intended to meet the Regional spotted owl habitat guidelines, which releases lands for other resource uses.

Prior to the Shady Beach fire, the Forest Service had little data on spotted owl use in the Bull Creek SOHA. Monitoring is presently being conducted to determine occupancy this year. Retaining the Bull Creek SOHA, in anticipation of habitat recovery in 80 to 120 years, would further restrict multiple use management of this area.

Large buffers should be provided around spotted owl nests. Sixty acres are needed by flightless juveniles, not the 330-foot radius that is prescribed.

The Willamette National Forest's policy for protecting known spotted owl nest trees outside of formally designated Spotted Owl Habitat Areas is to provide a 330-foot radius no-cut buffer and a 660-foot radius activity buffer during the nesting season. Changes to this protective buffer would be made as policy or management direction changes.

The possibility that the spotted owl may be listed as threatened or endangered should be addressed.

As future policy or management direction change with the status of the spotted owl, such policy or direction will be implemented.

The DEIS did not adequately address impacts to sensitive species of wildlife and inventories of these species are incomplete.

Wet areas and slump ponds within the project area were surveyed after the fire and were determined to have a low to no potential for occurrences of the spotted frog, Oregon chub, and western pond turtle. Project monitoring will continue to determine more definitely if any species occur in these kinds of habitat.

No survey has been done for potential habitat and occurrence of the one-spot rhyacophilan caddisfly, a sensitive invertebrate species. The habitat requirements of this caddis fly are not well understood. Management activities designed to maintain water quality will be used as mitigation for potential effects to this insect. Information on this caddsifly was added to the FEIS Chapter III, Wildlife - Threatened, Endangered, and Sensitive Species.

> **"Consultation with the (U.S. Fish and Wildlife) Service should be initiated under Section 7 of the Endangered Species Act if the project may effect peregrine falcons. We recommend that the final statement and the biological assessment, if required, include a brief statement of the procedures and/or measures which will be followed to ensure that there will be no adverse impact to peregrine falcons."**
>
> **"We recommend that spring inventories for potential habitat be conducted annually to determine the presence for breeding falcons or active eyries should be evaluated for their effects to breeding peregrine falcons."**

As described in the FEIS Chapter II - Monitoring, Monitoring Activities Common To Alternatives B, C, D, and F, surveys will be made of potential sensitive species habitat. Two cliffs within the project area are identified as potential nesting habitat. Early in the Shady Beach project, the U.S. Fish and Wildlife Service was contacted for their recommendations, at which time they asked that we monitor and determine if the cliffs are being used by peregrine falcons. The cliffs are to be monitored this spring, prior to any proposed harvest, and during following years, as long as management activities may take place within the vicinity of the cliffs. If peregrine falcons are found in the area, management activities will be postponed until further assessments and consultation with the U.S. Fish and Wildlife Service are made.

> **"The C.T. Beach arm of the reservoir may also contain potential eagle habitat. Some of the tree stands on the upper slopes and ridge lines facing the C.T. Beach arm may be within the project area. The amount and availability of specific trees or tree stands in or adjacent to the C.T. Beach area should be addressed in the final statement."**
>
> **"Proposed salvage operations may affect potential bald eagle habitat along the C.T. Beach arm of the reservoir... the final statement should consider development of salvage prescriptions for promoting or improving bald eagle habitat."**

The C.T. Beach arm of the reservoir does contain potential bald eagle habitat. Except for two proposed clearcuts, all other proposed units within 1 mile of the C.T. Beach arm are prescribed for partial cut. A partial cut prescription would salvage the fire-killed (generally smaller) trees. Even if the dead timber is salvaged, the area would remain as potential eagle habitat, consisting of large, open-canopy trees.

The two clearcuts are within an area of high mortality with very few surviving trees. The relatively large trees that did survive will be retained as future wildlife snags along with some existing snags. Similarly, in the partial cut areas, widely spaced green trees will provide potential eagle habitat, regardless of salvage harvest in the area. For more information on how harvesting in these areas will be accomplished, see Appendix G of the FEIS; Harvest Area Detailed Information.

The Bald eagle habitat has been improved by the fire through creating a more diverse mosaic of timber types and by opening up the previously closed canopy in the areas designated as a Bald Eagle Management Area. These improvements were not adequately acknowledged in the DEIS.

In the portion of the BEMA that was affected by the fire, the bald eagle habitat was improved due to the previously closed canopy being opened. None of the fully analyzed alternatives propose harvest units within the BEMA. The effects of the fire on the BEMA has been more thoroughly discussed in the FEIS - Chapter III, Wildlife, Threatened, Endangered, And Sensitive Species.

We offer our group's assistance to mark individual wildlife trees and monitor their survival. Work would include 1) identification and marking of wildlife trees; 2) monitoring timber sales to ensure that wildlife habitat guidelines are met.

Volunteer assistance will be welcomed in administering and monitoring the Shady Beach sales. Some aspects of administering the sales are technical and contractually binding. We suggest that people interested in volunteer assistance contact the District Ranger of the Rigdon Ranger District.

In cooperation with the Sierra Club, an action plan was developed, including a 1-day training session for volunteers. Beginning in May of 1989, volunteers are scheduled to work with Forest Service employees, including wildlife biologists and timber sale administrators, selectively marking wildlife trees within harvest units. Industry logging specialists may be consulted to further ensure the appropriate location of designated trees.

"Alt. C wants "half of the desired snags located on unsuitable timber lands, wildlife set-aside lands, and SMU's". "If concentrated in restricted areas, only a limited number of pairs can nest because of territory requirement. Manage for the species with the most limiting territory."

The FEIS has been modified to provide for retaining patches of snags within harvest areas as detailed in Chapter II - Resource Impact Mitigation and Enhancement, Mitigations and Enhancements Common to Alternatives C and D. Contract language will provide for a written agreement which will call for leaving an average of 10 snags in a group within harvest units and spacing between groups of 300 feet or greater. The number of snags per group will determine the number of groups per unit, and the snag group spacing will ensure distribution within the harvest unit.

"Manage for snags throughout the rotation by leaving replacement trees of green merchantable timber."

Within regeneration harvest units that have surviving trees, Alternative C, the preferred alternative will retain an average of 1.8 green trees per acre for future replacement snags as stated in Chapter II - Resource Impact Mitigation and Enhancement, Mitigations and Enhancements Common to Alternatives C and D.

Enough trees should be retained to account for losses that will occur due to yarding, burning and firewood cutting.

The retention of the prescribed number of wildlife trees during logging will be the responsibility of the purchaser and made a part of the contract. The need for slash burning to reduce the fire hazard or to prepare the site for reforestation will be assessed after logging has been completed. Broadcast burning of slash will be done under conditions of relatively high fuel moisture content to reduce fire intensity. Strip burning will be considered where feasible as an alternative to broadcast burning. Loss of wildlife trees due to firewood cutting was not analyzed as no firewood permits to cut standing dead trees will be issued in this area. Illicit firewood cutting in this area is not very likely due to the steep terrain.

> **"The final statement should address how each alternative would meet the requirements of the spotted owl Interagency Agreement among the (U.S. Fish and Wildlife) Service, the U.S. Forest Service, the Bureau of Land Management, and the National Park Service."**

The requirements of the Interagency Agreement between the U.S. Forest Service and the U.S. Fish and Wildlife Service (December 1, 1987) is intended to be met by implementation of the U.S Forest Service's Final Supplement to the EIS for an Amendment to the Pacific Northwest Regional Spotted Owl Guidelines, December 8, 1988. In implementing the guidelines, the Willamette National Forest has developed a network of Spotted Owl Habitat Areas (SOHAs) and standards and guidelines which are intended to meet the agreement requirements of providing numbers and distribution of spotted owls. The habitat and population inventories and monitoring requirements of the agreement are being conducted on the District under Forest and Regional guidelines. Research to determine validity of assumptions is being conducted out of the H.J. Andrews Experiment Station and the Pacific Northwest Range and Experiment Station, Olympia, Washington.

The number and distribution of spotted owl habitat areas was adjusted at the Forest level to replace the Bull Creek SOHA. This Forest level adjustment to the SOHA network was intended to fulfill this agreement requirement. Consequently none of the Shady Beach alternatives affect the network status. Alternative F would provide for retaining the Bull Creek SOHA as an addition above the network requirement.

> **"A barely adequate balance between timber value retrieval and ecosystem recovery might be achieved by leaving an average of at least 20 logs per acre." You should be particularly concerned with size, random dispersal, placing logs on steep, erosion prone slopes.**
>
> **The Final Alternative should "contain specific objectives for logs to be retained after harvest of the burned areas. Numbers and sizes should be based on recommendations by PNW experiment station scientists to maintain viable populations.**

Specific down woody material retention guidelines for Alternatives C and D have been revised (FEIS Chapter II - Resource Impact Mitigation and Enhancement, Mitigations and Enhancements Common To Alternatives C and D). These guidelines reflect the standards and guidelines in the Proposed Forest Plan/DEIS. Eight to 15 logs per acre will be retained, scattered randomly throughout a harvest unit. They will be at least 16 inches in diameter and at least 8 feet long.

> **Sizes of snags are important determinants of species populations. I suggest that statements in the FEIS clearly identify the sizes of trees/snags retained that will be sufficient to maintain viable populations of all species of primary cavity nesters."**

The FEIS contains an expanded description of wildlife tree retention guidelines. This can be found in Chapter II - Resource Impact Mitigation and Enhancement, Mitigations and Enhancements Common To Alternatives C and D. Trees to be retained will be greater than 18 inches in diameter and at least 60 feet tall. These guidelines were designed to provide habitat for 40 percent of the potential primary cavity nester population, which is considered to be the minimum viable population level in the Proposed Forest Plan/DEIS.

> **Two main elk herds have been identified in the analysis area. Information on how elk are affected by hunting, natural mortality and recreation activities would be helpful.**

This additional information has been incorporated into the FEIS Chapter III - Wildlife, Big-game Habitat.

> **"...The evaluation of big game habitat did not fully evaluate what the surrounding areas can provide in terms of habitat. Migration of the big game was not discussed as well."**

One of the reasons that a 22,456-acre analysis area was used to evaluate a 9,000-acre fire was that this larger area would best represent the condition of all the habitat used by animals that frequented the burned areas. We considered areas outside of the analysis area and determined that these areas need not be evaluated in terms of wildlife habitat as no off-site effects are expected. Migration of the elk herds in the analysis areas was discussed in the DEIS Chapter III - Wildlife, Big-game Habitat.

> **"Habitat corridors, especially along Hills Creek, must be maintained to connect surviving patches of the forest over the burn area. These areas will regenerate wildlife carrying capacity much faster than if they are cut."**
>
> **"We suggest giving more consideration to wildlife habitat by"...maintaining wildlife corridors from Bull Creek SOHA to Hills Creek.**
>
> **"Retention of Corridors would prevent severe reduction and possible elimination of about 16 species jeopardized by the cumulative impacts of the proposed salvage logging program, the wildfire, and previous management which has been deficient in maintaining wildlife trees and down logs."**
>
> **More habitat for old-growth dependent species should be maintained, especially the spotted owl. Existing old-growth in the analysis area is very fragmented and additional fragmentation will worsen the habitat availability for old-growth dependent species.**

There was substantial public concern for maintaining connective habitat corridors. For this reason the Interdisciplinary Team considered two corridor proposals. One proposal, formulated by the Sierra Club, was modified by the ID Team to become the second proposal.

Three primary connective corridors could be managed under this proposal. The corridor along Hills Creek incorporates the Hills Creek riparian area and connects habitat north of the fire area and southeast of the fire area. Another corridor is in the Bull Creek drainage, connecting habitat on the west end of Bull Creek to habitat southeast of the fire area. The third corridor is adjacent to Hills Creek Reservoir and connects habitat on the west end of Bull Creek to habitat on the Hills Creek peninsula area.

A corridor connecting the Shady Gap pine marten habitat area to Hills Creek was also evaluated. It was determined that objectives in that corridor could be met as much as possible with mitigation measures as currently planned. This corridor would be minimal due to intensity of past management and severe fire mortality in the area.

All of the corridors would have some level of timber harvest activity, with the majority of their area being partial cut rather than clearcut. There would also be some no-harvest areas within each of the corridors where fire mortality is low. Small, intensively burned areas would be helicopter yarded, providing a high potential for maintaining green trees, snag habitat, and down log habitat. South-facing slopes and dry, gravelly soils would not be broadcast burning (on a site-by-site basis) so that organic material and large woody material would be maintained. Green trees would be maintained where possible within the corridors. This is a change from what was presented in the DEIS. The proposal to implement these connecting corridors will be addressed in the Record of Decision.

Harvest activities will be conducive to maintaining potential for recovery of old-growth habitat features. Many of the live trees in the corridors are old-growth Douglas-fir. Green trees and a high level of snag and down log habitat will be maintained within the corridors. Harvest activities will involve removal of dead understory trees, and patch cutting of intensively burned spots. After the understory regenerates, those areas where a good component of residual old-growth and snag habitat has been retained will provide a relatively high value corridor habitat. In other areas outside of the corridors, where partial cuts are prescribed, a similar potential can be expected. Old-growth Douglas-fir is predominant in the green tree component.

Oregon Department of Fish and Wildlife recommends that the average open road density in the Forest not exceed 1.5 miles of road per square mile. How well does Alternative C meet that guideline?

Implementation of Alternative C, would result in closure of roads within the subwatersheds affected by the fire as described in the FEIS - Chapter II, Alternatives Considered In Detail, Mitigations And Enhancements Common To Alternatives B, C, D, and F. This road closure would leave an average of 2.1 miles per square mile open to vehicle use. Open road mileage within the two winter range areas would be 1.8 miles and 2.3 miles per square miles.

RECREATION

> **"There will be considerable traffic on most roads within the fire area....for the duration of the project." How are you planning to minimize the potential for accidents, and control traffic?**

A traffic plan is being prepared for the recovery projects in anticipation of this problem. Items considered are traffic control over main roads, signing, speed control, access control, rerouting traffic when necessary, and access to private property. Details of this traffic management plan can be found in the FEIS Chapter II - Alternatives Considered In Detail, Resource Impact Mitigation and Enhancement, Mitigations and Enhancements Common To All Alternatives.

> **The Forest Service should take advantage of opportunities created by the fire to educate the public about the effects of wildfire, fire prevention, the recovery of the fire area, and the benefits of forest management.**

This opportunity was voiced by the public early in our planning process, and we concur with the importance of informing and educating forest visitors. (Chapter II - Features Common to All Alternatives). The Rigdon Ranger District is now planning a two-phase program to develop this interpretive program as detailed in the FEIS Chapter II - Features Common To All Alternatives.

The first phase will educate visitors during salvage operations during the next 2 years, and provide for their safety. The project area in which salvage operations occur will be closed to recreation traffic. Emphasis will be placed on traffic control and signing to direct the public away from hazardous areas.

The second phase will include permanent signs to interpret the effects of the fire, describe the recovery process, how the area is being managed, and to promote fire prevention. Self-guided tours may be designed and signs installed.

> **The Forest Service must keep in mind that public safety is very important. "When salvage operations begin, a restrictive system to limit traffic in the fire area should be in place."**

The Forest Service realizes there will be increased hazards to the public as a result of increased logging activity inside and outside the fire area. We are especially concerned about traffic and pedestrian hazards along Forest Service and Lane County roads leading to the fire area from Highway 58. We are also concerned about the effect increased traffic will have on Highway 58. The Forest Service, with input from the State of Oregon, Lane County, forest industry, and the City of Oakridge, is developing a safety plan to be in place before operations begin (FEIS Chapter II - Mitigations and Enhancements Common to Alternatives B, C, D, and F).

VISUAL QUALITY

> **"Since the characteristic vegetation of the fire area has been significantly modified by the fire, ... minimization of the visual recovery period should be the main visual quality objective for the analysis area". We suggest that visual quality of the area would return to Forest Service standards much faster than 30 years if salvage operations and reforestation are implemented. Please explain why it will take so long?**

Visual quality objectives (VQOs) for the area are derived from the Proposed Forest Plan/DEIS. The visual quality recovery period for all alternatives is based on the return of the landscape to a natural appearing texture, line, and color which will require about 30 years as detailed in the FEIS - Chapter IV, Visuals. This timetable would be attained by salvaging damaged stands and reforesting immediately with conifers. Some recovery will be evident in less than 30 years as young stands establish themselves, but not to the level we seek to attain.

> **"Dead and dying trees are not visually pleasing". We can hasten nature's rehabilitation in these stands by removing dead and dying trees, and quickly reforesting them.**

> **"I would rather see clearcuts and fresh green plantations than interspersed dead and dying stands of timber for the sake of leaving undisturbed areas".**

The discussion of the area's scenic status has been changed in the FEIS Chapter III - Visuals, in Chapter II - Comparison of Alternatives, Visuals, Recreation, and in Chapter IV - Visuals, as the result of input from landscape architects in the USDA Forest Service Region 6 office. Whether or not dead trees are pleasing is certainly a matter of personal opinion. Forest Service scenic management goals are intended to maintain the natural appearance of the landscape. Since fire has had a large influence on the vegetation in this area, both recently and over time, the Shady Beach fire has had little effect on meeting these goals of maintaining a naturally appearing landscape. Indeed, the lack of snags in a fire-influenced area would be very unnatural.

ECONOMICS

Mitigation measures cost a lot of money. How do you weigh the benefits against costs of initiating them?

The dollar benefits resulting from expenditures on mitigation and monitoring measures are difficult to measure. Generally speaking, all of the mitigation and monitoring projects are those which are mandated by either state or Federal law. For example, the State of Oregon has water quality standards while the existing Federal Spotted Owl FEIS and current direction from the Federal Circuit Court mandate that any known and potential SOHA's be identified and monitored. The proposed Forest Plan and current FS Region 6 guidelines contain specific measures for ensuring continued multiple resource management on all national forests. The economic monitoring cost can be measured in terms of informational needs in assessing costs and benefits of future timber sales, especially in fire-kill areas on western Cascade forests.

Logging and transportation costs used in the DEIS seem to be too high, resulting in low stumpage values. Stumpage prices paid on the Willamette National Forest greatly exceed values used for your analysis.

Logging and transportation costs are determined from empirical estimates from Rigdon Ranger District sales over the past 5 years. In the FEIS, the stumpage values have been increased to account for new information obtained from recent bids on Rigdon Ranger District timber sales (Chapter IV - Social and Economic, Stumpage Value and Mill-Pond Value and also Appendix F - Tables F1 and F2).

Opportunity exists to use a portion of salvage sale receipts for rehabilitation and enhancement of resources. What types of activities are planned?

A specific list of rehabilitation and enhancement activities is included in the FEIS (Chapter II - Alternatives Considered In Detail, Features Common To All Alternatives, and Resource Impact Mitigation and Enhancement). Monies for mitigation, monitoring, and further rehabilitation projects will come from salvage sale receipts (Appendix F - Tables F1 and F2). Specifically, KV monies collected from salvage sales will finance these projects by direction of the Knutson-Vandenberg (KV) Act of 1976.

"Each contiguous harvest unit should stand on its own, both economically and biologically."

Each harvest unit will return monies to the Federal treasury with the exception of two small areas with marginally valued second-growth killed in the fire. These two areas will cost more to administer than will likely be received for the timber. Harvesting these areas has been proposed to best utilize this marginal resource and more importantly, to allow this site to be properly prepared for reforestation. The IDT has determined specific harvest prescriptions and mitigation measures to meet biological objectives in each of the sale areas that can stand on their own economically.

"Apparently, only timber resources were given a market value. We hope that for purposes for economic assessment, parameters such as recreational resources, such as boating, birding, camping, fishing...were also included."

The timber resource is the only resource assigned a market value in this particular area analysis (FEIS Chapter IV - Social and Economic, Introduction, Assumption 5). Economics is defined as the allocation of scarce resources based on demand for a resource at the margin. In other words, a resource is correctly assigned a market value when there is a permanent loss of that resource and no other existing opportunities for that resource. In the case of the Shady Beach project area, the ID Team determined that the only resource which would suffer a permanent loss of which there were not any substitutes available, is the timber resource. For example, recreational opportunities at Hills Creek Reservoir (campgrounds, picnic areas, fishing, and boating opportunities) will not be significantly affected by the fire. If C.T. Beach is closed, it will be on a temporary basis and there are similar recreational opportunities in the immediate area. Big-game hunting opportunities are not expected to decline due to the fire, though road closure will affect vehicle access. Mitigation projects are funded to enhance cover and forage area recovery. In summary, market or nonmarket dollar values used in any area analysis-type EIS must be defensible in economic terms for that specific area.

We question your methods and figures for wage levels, and numbers of workers in the lumber/wood product industry. What is IMPLAN and how was it used?

The figures used for wage and job numbers were determined from data obtained from Oakridge-area mills and from additional information obtained from statistics provided by the State of Oregon Employment Division in Eugene. The wage levels are an average wage income for loggers and mill workers, including temporary employees hired through Eugene employment agencies. The job figures in the EIS were converted to full-time equivalent jobs. Job numbers listed in most State and Federal employment listings do not differentiate between full-time and part-time jobs. It is difficult to compare any demographic data from different sources without knowing the assumptions that "drive" the data results.

IMPLAN is a Forest Service model used in estimating economic effects in Forest and area analysis EIS's. IMPLAN is an input-output model which is one of a class of economic impact models. Input-output models assume a linear and proportional relationship between changes in industry outputs (especially those industries which export products outside the economic unit) and the economic welfare of the area in terms of total jobs in all sectors and wage incomes. Input-output models assume that service sector-type jobs such as doctors, restaurants, motels, movie theaters, etc. are influenced by the number and intensity of manufacturing industry jobs and incomes. See the FEIS - Appendix F - Economics for more detail.

"Revenues realized in future green tree sales are increased at an annual rate of one percent in the (Willamette) Forest Plan, rather than held constant as in the DEIS" (Chapter IV, page 104).

The economic analysis in this area-specific EIS does follow many of the assumptions made in the Forest Plan and EIS. However, there is no legal mandate which says that an area analysis EIS must adhere strictly to the Forest Plan. Based upon the uncertainty of changes in timber sales revenues and costs, and the relatively short time frame of the salvage sales, an annual percent change in either revenues or costs was not used in the Shady Beach EIS.

"There is no consideration of the economic impacts outside the local area. Consideration of statewide impacts such as state income tax generated by each alternative would be valuable."

The estimated jobs and wage incomes are based on the volume of timber harvested on the Shady Beach analysis area. It is expected that much of volume will be sold to local area industry (i.e. Eugene/Springfield, Oakridge/Westfir, and Roseburg communities). However, the jobs are specific to this sale volume regardless of the location of the high bidder.

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An approximate marginal State income tax of 6 percent could be applied to the wage incomes. If such impacts outside the Shady Beach local "area of influence" are estimated, there are additional benefits as well as costs which must be evaluated.

> **"Alternative C does not meet the Forestry Program For Oregon goal for community stability". The difference in revenues generated by Alternatives C and B may significantly affect Lane County.**

The Forestry Program For Oregon goal for community stability is related to log supply and to Federal revenue sharing monies returned to counties from the sale of commodities off of Federal lands (i.e. Forest Service timber). It is true that county revenue sharing payments increase as the price and volume of Federal land commodities increase, but regardless of which alternative is implemented for the Shady Beach Fire Recovery Project, the volume sold from the Willamette National Forest will remain the same. As a result, county revenues will stay the same over time. Additionally, revenue sharing payments are affected by the type of logging system used; more expensive logging systems decrease dollars returned to the Federal treasury. However, National Forest lands are managed to provide a variety of forest resources as mandated by the Multiple-Use Sustained Yield (MUSY) Act of 1960, the Resources Planning Act (RPA) of 1974, and the National Forest Management Act (NFMA) of 1976. There is no clear mandate in National Forest land management-related laws to promote or maintain community stability.

The effects of resource management on local economies are evaluated in the planning of the EIS process. The Forest Service has been and is concerned with the economic well-being of communities adjacent to National Forest lands.

> **"Different estimated growth losses are provided for each alternative, but information was not provided on the impact of growth loss on future Allowable Sale Quantity (ASQ) of the Willamette National Forest."**

The growth losses displayed for each alternative result from reforestation lags and from partial cutting that would maintain a partially stocked stand of trees on an areas for a period of time. Growth losses were different for each alternative because there were differing numbers of acres in the above categories under each alternative. This loss of growth would have some small effect on the future ASQ for the Willamette National Forest. Since this loss involves only a lag in attaining full stocking on these lands and since it would only occur on a very small portion of the Forest, the affect on future ASQ levels was not calculated, as it would be too small to be significant, considering the uncertainties of the growth loss predictions.

The yield tables used in the Proposed Forest Plan/DEIS to calculate ASQ levels do account for a small annual acreage loss due to fire or other catastrophic (i.e. unpredictable) events.

> **"I can't tell from the economic section of the DEIS whether the project is going to be better for the community today and not so good tomorrow."**

The community well-being issue is a very difficult one to analyze. Whether the community is "better-off" today as opposed to tomorrow as a result of management decisions on the Shady Beach project is almost impossible to predict. What takes place solely on this specific area will probably not effect the well-being of the Oakridge/Westfir community. The concept of community may be broad or narrow. It could refer strictly to economic well-being in terms of jobs and income, or refer to a much broader social infrastructure. What the community wants its home area to look like 50 years from now may be a consideration. Macro-economic forces (i.e. interest rates set by the Federal government, international trade policies, etc.) outside the State or Forest Service could affect Oregon's economy in future years in a variety of ways. These are but a few of the questions that come to mind in thinking about the community well-being issue; there are no easy answers.

Salvage sale contributions toward county revenue sharing payments will be shared with all counties containing Willamette National Forest acreages on a per acre basis. Salvage sale volumes will contribute to Oregon's economy. Whether salvage volumes contribute towards the Oakridge/Westfir economy depends on who is awarded the sale (i.e. the high bidder).

> **It appears that the only reason you are cutting green trees is to justify logging systems. I recommend you restudy the cost of using helicopter versus skyline systems.**

One of the reasons that we have proposed the harvest of green trees to facilitate logging is not that we have to harvest them at this time to justify a certain system, but that in the future, when it is time to harvest those trees that were left, it would not be feasible to harvest them with a skyline system because there would at that time be a young, vigorous stand that would be in the way and would be damaged if a more cost effective skyline yarding system was used. In this case, we would be forced into using the more expensive helicopter system to access an areas that could be accessed more efficiently if we had scheduled the harvest differently. See the definition of Logical Unit Boundary which has been included in the FEIS Glossary for more information on why we proposed to harvest some green trees.

The costs of using helicopters or skyline systems to log areas are well known and are documented in Appendix F of the FEIS. Helicopter logging may be up to twice as expensive to operate as a skyline system. When we decide what system should be used on a given piece of ground, there are several things besides the cost of a potential logging system that need to be considered. These considerations include the presence or absence of access roads, the type of harvest prescription and resource protection required, the level of scenic management needed, the costs (both economic and in resource effects) of road construction, and the ability of a given logging system to accomplish specific resource objectives such as full log suspension. There are also benefits to having a road system built that need to be taken into account, aside from providing access to a harvest unit, as when efficient access is needed in the future for fire protection or reforestation.

Because of the large difference in cost between these two logging systems, and because of the mandate that we have to manage the Willamette National Forest in the most cost efficient manner while not affecting the productivity of the land, we tend to select skyline systems when they can achieve all the objectives that are identified for a given area. When those objectives cannot be met with the most cost efficient logging system, cost may then no longer be a criteria in making this decision. Sometimes, skyline systems can be the more expensive logging system, as when the harvest prescription specifies that few trees per acre be cut and yarding distances are long. If there are some trees to be left that make skyline logging impractical, the increased cost of another logging system needs to be compared to the value of leaving those trees. If the costs are substantially higher than this value, we would opt for the most cost efficient system, and this, with other considerations listed above, is how we have made these decisions on which logging system is most appropriate for a given area.

PLANNING

> **The decision to analyze 13,293 acres in addition to the fire area "...artificially dampens the differences in impacts calculated for the various alternatives....The FEIS should identify all impacts based on the 9,000+ acre burned area."**

Guidelines developed by the Council on Environmental Quality as directed by the National Environmental Policy Act mandate that cumulative effects be addressed in all environmental impact statements. The ID Team for the Shady Beach Fire Recovery Project identified water quality, wildlife habitat, and scenic quality as areas where cumulative effects needed to be addressed in this project, as described in the introduction to Chapter IV. To adequately address cumulative effects, entire watersheds or home ranges of big-game herds need to be analyzed. In order to accomplish this objective, the ID Team decided that all subwatersheds affected by the fire had to be analyzed, hence the 22,456-acre analysis area.

> **"The analysis should consider the risks created for forest workers and the public under each alternative."**

Though this project is somewhat larger in scope than most projects proposed by the Willamette National Forest, we do not feel there are any safety problems beyond those normally considered in the day-to-day management of forest resources. This determination is supported by a letter that we received from the USDI Department of Health and Human Services which states, "We did find that the EIS has thoroughly analyzed the pertinent environmental issues and has developed adequate mitigation measures for unavoidable impacts. We feel that the project does not pose any extraordinary risks to workers or the general public." A transportation plan has also been developed for this area that specifically takes into account the increased traffic that this area will experience during timber salvage operations. This transportation plan is contained in the Shady Beach Fire Recovery Project Analysis File at the Rigdon Ranger District office, Oakridge, Oregon.

> **"Alternative A must be displayed in detail. This is needed to portray the true cost of meeting all current management direction and compliance with existing laws."**

Alternative A was not displayed in detail as it became apparent early in its analysis that it could not be implemented without unacceptable environmental effects, some of which were contrary to Forest Service policies and existing legislation. The economic effects of Alternative A, however, were analyzed specifically to illustrate the above tradeoffs. The results of this economic analysis are displayed in the FEIS Chapter II - Alternatives Considered But Not Given Detailed Study. The following table will give a more clear idea of how this alternative compared economically to other alternatives that were developed in detail.

INDICATOR	A	B	C	D	F	E
Economic Efficiency						
----net benefits* (mm$) 1989-1990	48.8	38.3	33.5	31.5	23.0	-0.7
----present net value* (mm$) 1989-2039	117.5	103.8	98.0	98.2	88.6	77.0
Economic & Social Impacts 1989-1990						
----county revenues* (mm$)	13.0	10.5	9.4	8.6	6.6	0
----jobs* (number,direct)	1112	903	820	763	560	6
----wage income* (mm$)	22.8	18.5	16.8	15.6	11.5	.125

> **"I would like to see a mix of plans C, D, F put into action. The alternatives have little flexibility and they seem to be a little too absolute."**

There have been a number of changes in the way the alternatives are described from the draft to the final EIS. Characteristics from all alternatives have been incorporated into the description of the preferred alternative as the result of public comment. These changes can be found in the FEIS - Chapter II, Alternatives Considered In Detail.

> **"The DEIS is written in such a way to bias the reader into accepting Alternative C as the most reasonable alternative."**

Alternative C strikes a middle ground between the sometimes mutually exclusive goals of minimizing environmental effects and salvaging of all fire mortality. It has been, to a certain extent, presented in a more favorable light as it best accomplishes all the objectives developed for this project. It was not our intent to bias Alternative C and the FEIS incorporates many editorial changes to be more clear and objective in the the description and evaluation of alternatives.

> **"Why not analyze an alternative that meets the direction of the current (1977 Willamette National Forest Plan) in terms of land allocation, but includes some (more desirable) standards and guidelines contained in the Draft Willamette National Forest Land and Resource Management Plan/DEIS?"**

Most of the difference between the Current and Proposed Forest Plans for the Shady Beach analysis area is in the standards and guidelines. The Proposed Forest Plan/DEIS specifies that only about 10 percent more of the analysis area is designated as scenic land allocations than is designated by the Current Forest Plan/FEIS. There would be little difference in the preferred alternative if this plan were designed under the Current Forest Plan/FEIS. We have used the Proposed Forest Plan/DEIS allocations to better maintain future management options and to assure that the projects proposed in this EIS will not have to be modified latter when the Proposed Forest Plan/DEIS is approved.

> **"We found no mention of the (non-Forest Service) Interdisciplinary Team members anywhere in the DEIS. We feel they should be named or otherwise identified."**

Non-Forest Service members of the ID Team were mentioned in the DEIS Chapter II - Alternative Development Process. Unfortunately, individual names were not given and these members were inadvertently omitted from the List of Preparers in the DEIS. They are now included in the FEIS. The involvement of these people was continuous and valuable throughout the planning process. These members were:

Bob Russell, Sierra Club
Bob Lindsey, Willamette Timbermen Association
Burt Cleary, Oregon Department of Fish and Wildlife - Corvallis
Mark Wade, Oregon Department of Fish and Wildlife - Springfield

The DEIS indicates the 1977 Forest Management Plan gives management direction. Most people do not have it available for reference.

As mentioned in Chapter I - DEIS Organization, the 1977 Forest Management Plan for the Willamette National Forest is available for viewing at the Shady Beach Fire Recovery Project office in Oakridge, Oregon. This document can also be viewed at the Willamette National Forest Supervisor's Office in Eugene, Oregon, or at any of the seven District offices.

If mitigation measures for Alternative C were applied to Alternative B, we could better protect resources and not adversely affect the salvageable volume.

Many of the mitigating measures prescribed for Alternative C were included in Alternative B as described in Chapter II - Resource Impact Mitigation and Enhancement, Mitigation and Enhancement Common To Alternatives B, C, D, and F, Numbers 4, 5, and 6. These common measures include hardwood planting in riparian areas, large woody debris retention in stream channels, placement of erosion control structures, and harvest restrictions adjacent to bald eagle roosting areas and osprey nests.

Several mitigating measures that are the most effective at reducing immediate environmental effects are the retention of riparian buffer strips and wildlife trees. These two mitigating measures tend to reduce salvageable volume the most and are also the most effective measures in terms of speeding the recovery of various resource values. If these and other mitigating measures were incorporated into Alternative B, the volume salvaged would decrease and this alterative would no longer be substantially different from Alternative C.

"It is evident that much more monitoring is presently occurring than is described in the DEIS. Such data would be important to those interested in the outcome of this project."

Several of the on-going monitoring projects were not included in the DEIS as they were initiated before it was published and were covered by separate documentation. This discrepancy has been rectified in the FEIS and a complete reference to all monitoring projects can now be found in Chapter II - Alternatives Considered In Detail, Monitoring. The actual monitoring plans are contained in the analysis file for this project area and are available for review on request.

Close coordination between the monitoring staff, implementation staff, and sale administrators is necessary to ensure adherence to standards and the effectiveness of monitoring.

"The ultimate value of the final adopted project plan depends exclusively on its effective implementation and monitoring. The best decisions are site-specific and made on-the-ground. This requires adequate professional staff levels and resources." How will you meet this need?

Direction for creating a special Project Monitor position on the Rigdon Ranger District has been incorporated into the FEIS Chapter II - Alternatives Considered In Detail, Monitoring. The Rigdon District Ranger will ensure that the District is organized to coordinate that all activities involved in the implementation of recovery projects are in compliance with the direction in this document and to insure that the results of monitoring activities are communicated to those people involved in the implementation of projects. In addition, great effort has been made to recruit skilled and experienced individuals from several districts on the Willamette National Forest and in some cases from other Forests to be involved in the field implementation of these projects.

"In the glossary, the DEIS defines gross volume, gross merchantable volume, net merchantable volume, and expected merchantable volume. One unit of volume should be used throughout, preferably net merchantable."

These are confusing terms and in the FEIS alternatives are compared only by gross merchantable volume harvested. Gross merchantable volume is used since it reflects all volume with a commercial value, not just the lumber products that constitute net merchantable volume. All the above terms, however, still appear in the glossary as they are used and are essential to the economic analysis contained in Chapter IV.

"The summary lists six different issues. In chapter I,...a seventh issue is added; Cumulative Effects.:" Please explain the need for this issue.

This issue was originally listed to make sure that cumulative effects were addressed as mandated by the Council on Environmental Quality guidelines for the preparation of environmental impact statements. As analysis of the project progressed, it became clear that cumulative effects would be more properly addressed under each specific resource concern. Cumulative effects has been eliminated as a separate and specific issue in the FEIS.

"Forest fragmentation is probably the most critical long-term issue currently facing all national forests....During the discussion of the various alternatives (Chapter IV and Appendix G) fragmentation evidently received limited attention."

The fire has fragmented the stands in the analysis areas to the extent that there is little to be done in the near term to limit fragmentation. The effects and amount of forest fragmentation are quantified by the Interior Species Index that is explained fully in the introduction to the Wildlife section of Chapter IV. It is correct to say that the issue of fragmentation received a small amount of attention. The scoping of this recovery project revealed a number of other issues that were of considerably greater concern than forest fragmentation, but this issue will be addressed in the Record of Decision.

We do not favor salvage logging as the exclusive management prescription for all burned areas on National Forest Lands.

The Current Forest Plan/FEIS, a general, programmatic land-use plan, prescribes that forest mortality be salvaged as long as the environmental effects of that salvage are acceptable. The Shady Beach Fire Recovery Project EIS was written specifically to determine, on a site-specific basis, whether, and to what degree, salvage was acceptable in that particular area. In that sense there is no exclusive prescription other than the fact that the environmental effects of such an activity must be extensively studied before any salvage occurs.

"Some proposed road and unit locations are already staked and marked, as if adoption of alternative C is a foregone conclusion."

Implementation of such a large project is very time consuming, especially if enough time is allowed for high-quality field work and preparation of timber sale contracts. In order to provide a sufficient amount of time for the numerous sale preparation activities to occur and still salvage dead timber before it begins to deteriorate, unit and road location was begun in March of 1989. This involves the risk of having to redo some of this work if the final decision is very different from the proposed alternative, but nothing has been done that could not be reversed due to public review of the DEIS.

> **Had the fire not occurred, how many of the 2,061 acres on high-risk soils would otherwise be harvested under normal management direction?**

Since virtually all areas of high-risk soils are in the commercial forest land base, all the acres would eventually be harvested under normal management direction. The type and timing of harvest for these areas would likely be quite different than what has resulted from the decision to salvage fire-damaged timber. Specifically, areas with high-risk soils might have been partially cut and certainly they would not all be harvested at once to avoid any potential for accelerating mass soil movement.

> **The DEIS did not adequately discuss the total effects of the fire, including water, fish, wildlife, air, and other values.**

One of the reasons the No Action Alternative, Alternative E, was evaluated is that it does describe the effects of the fire alone, separate from any potential management activities. The environmental effects listed for Alternative E - No Action in Chapter IV include the effects of the fire on all affected resources. Existing post-fire conditions are also described in Chapter III, the Affected Environment.

> **Early in your planning process, Alternative F was developed to emphasize soil and water protection. You later included wildlife habitat as a resource to be protected as well. "Although it is difficult to tell, my guess is that the timber volume reduction due to wildlife is substantially greater than that due to protecting soil and water resources. The result is that Alternative F is much less attractive to the decision maker and we may lose the opportunity to do the best possible job of restoring long-term productivity to Shady Beach".**

The wildlife habitat objectives were added to Alternative F because it became apparent during analysis of this alternative that many of the measures being taken to protect soil and water resources were also providing for wildlife habitat needs. Stream management units prescribed to maintain water quality are also very beneficial to wildlife, as are down logs retained for site productivity, and green trees retained for hydrologic functions. The only mitigating measure included in this alternative that reduces the amount of harvested volume and which was proposed primarily to benefit wildlife resources is the retention of wildlife trees. Since wildlife tree retention reduced the potential salvage volume of this alternative by only 6 percent, we feel the inclusion of all three resources in one alternative does not affect the attractiveness of this alternative to the decision maker. Since the mitigating measures benefit wildlife as well as soil and water resources, we feel it is appropriate to identify all the resources that benefit under this alternative.

"I support Alternative "B" for the Shady Beach Fire Recovery Project. Alternative "B":

- *Prevents the waste* of valuable timber resources
- *Protects wildlife* habitat
- *Protects water quality* and fisheries
- *Provides for more reforestation* of devastated areas
- *Provides adequate roads* for fire protection and future recreation
- *Prevents the spread of insects and disease*
- *Returns the most economic benefit* to the county, school districts and timber-dependent communities
- *Balances timber salvage* with environmental concerns"

The above comment is reproduced verbatim from one of 6,600 signed coupons.

The purpose of the proposed action is: 1) to implement recovery projects minimizing further adverse impacts in the area; 2) to salvage fire-killed or damaged timber while protecting other resource values; and 3) to reforest burned areas quickly in order to maintain their long-term biological potential (FEIS, Chapter I - Purpose and Need). The intent of the Shady Beach Recovery Project is to salvage fire-killed timber quickly to minimize deterioration of dead trees and to prevent a buildup of forest pest populations. The Shady Beach Recovery Project analysis shows that Alternative "C" harvests a majority of the fire mortality and at the same time better protects other resources in the area, especially in respect to protecting wildlife habitat, water quality, and fisheries. Overall, the project analysis shows that Alternative C best "balances timber salvage with environmental concerns".

POLICY

> **"It is likely that the National Forests will be faced with projects similar to this....I would urge the Forest Service to explore opportunities to utilize this project for future research studies to improve management and recovery techniques in the future."**

The Willamette National Forest, in cooperation with several other agencies, is involved in a number of studies that address how this area recovers from the effects of the fire. The Pacific Northwest Forest and Range Experiment Station is initiating a study on the effects of harvesting fire-killed stands growing on unsuitable soils. The Oregon Department of Fish and Wildlife will conduct a study on the amount of competition that occurs between various grass seed mixes planted to improve big-game forage production and planted conifer seedlings. We are also monitoring the former Bull Creek SOHA to verify whether the fire has affected the use of this area by northern spotted owls.

A number of sites which were monitored for several years before the fire to develop a plant association classification for the Willamette National Forest have also been reserved from salvage harvest to allow a future study on how quickly various sites recover from effects of the fire. Of particular interest in this last study will be a long-term evaluation of snag use by various species of animals and birds and how long these snags last as effective habitat. More details of these studies can be found in the FEIS, Chapter II - Alternatives Considered In Detail, Monitoring.

> **"A more adequate EIS should be prepared to supplement the environmental documents now in existence concerning proposed fire salvaged sales."**

There are no existing environmental documents that address fire salvage sales. This is one of the main reasons that we have decided to do an EIS for this project. The Current Forest Plan/FEIS directs that forest mortality be salvaged where it is environmentally acceptable and efficient to do so. This plan, however, does not provide site-specific direction and the Shady Beach Fire Recovery Project EIS was prepared to provide that site-specific analysis and direction.

> **"The Forest Service needs to address cumulative impacts in the context of how its timber management program is increasing the forest's future susceptibility to fire by creating additional openings where dry fuel....is easily ignited once a...fire is started."**

This is a matter of great concern to the Forest Service and fuels reduction is one of the primary reasons that logging slash is burned after harvest. Created openings are drier and fuels in such areas are more easily ignited. Fires in young plantations can be quite devastating because young trees are not very resistant to fire, so they often are killed. The dry grasses that predominate in open areas can result in very fast fire spread, but mature stands contain much more fuel. Though the spread of a fire in a mature stand may be much slower due to the lack of fine fuels, the fire is usually more intense due to the greater amount of woody fuel.

We do not consider that the creation of openings is increasing the forest's susceptibility to fire. Though a fire start may be more likely in a young plantation, these openings are relatively temporary features in the forest landscape. Once the crowns of the trees close, the fire hazard is reduced due to the shading out of flammable undergrowth, the cooler temperature that are typical under a closed forest canopy, and due to the slash treatment that reduced the residual fuels in the area. In addition, openings created by harvest are usually accessed by a road, which makes fire much easier to control, should one start.

"It is hard for me to believe that with the log shortage situation in Oregon as critical as it is that the Forest Service would even consider any alternative that does not attempt to salvage the maximum amount of timber available."

This EIS was conducted to help us decide just how much timber is available for harvest. The various pieces of Federal legislation that direct how the Forest Service manages forest land, which include, but are not limited to the National Environmental Policy Act and the National Forest Management Act, mandate that we consider effects on a host of resource values in addition to the economic effects of a given harvest proposal. This is true whether the proposal is part of our general forest management program or as the result of a catastrophic event. The intensive analysis required for the Shady Beach Fire Recovery Project EIS determined how much timber was available for salvage. In addition to purely economic considerations, public issues drove the decision-making process to protect other resources as well. This resulted in retention of some dead trees to provide for values such as wildlife habitat or stream channel stability.

We are concerned that since a portion of the Bull Creek Spotted owl Habitat Area (SOHA) was burned, the Forest Service will replace it elsewhere. The remaining unburned area should be maintained as a SOHA.

The Bull Creek SOHA will be replaced, though the selection of a replacement location is outside the scope of this document. The Final Spotted Owl Supplement to the Environmental Impact Statement for an Amendment to the USDA Forest Service Pacific Northwest Regional Guide, approved in the fall of 1988, provides specific direction for the amount and condition of habitat that must be included in SOHAs. While portions of the remaining unburned habitat in the former Bull Creek SOHA are to be retained in a bald eagle management area and a pileated woodpecker management area, it can no longer be included in the Willamette's network of SOHAs because it does not contain enough suitable habitat to meet Regional requirements. Details on the amount of habitat affected and remaining in this former SOHA and information on the Regional Guidelines can be found in the FEIS, Chapter III - Wildlife, Threatened, Endangered, and Sensitive Species, and in Chapter IV - Wildlife, Effects Common To All Alternatives, Threatened, Endangered, and Sensitive Species.

"The whole question of the Forest Service's policy on SOHA replacement when territories are destroyed by natural catastrophe must be addressed on a regional level."

This is true and it is being dealt with at a regional level. As of this writing, the Final Spotted Owl Supplement to the Environmental Impact Statement for an Amendment to the USDA Forest Service Pacific Northwest Regional Guide is under appeal and one of the issues in this appeal deals with the ability to replace SOHAs should they be destroyed by catastrophic events. This question is important, but is beyond the scope of the Shady Beach Fire Recovery Project FEIS.

The DEIS did not adequately address the cause of the fire, and Forest Service policies that contributed to the cause.

The cause of the Shady Beach fire was never determined, so it would be difficult to address whether any Forest Service policies contributed to the cause. Since the Shady Beach Fire Recovery Project EIS was done to determine the effects of the fire and resultant fire recovery projects, the cause of the fire is outside the scope of this document.

Further study is needed to accurately reflect the requirements of spotted owls and the dependence of other species on old-growth habitat for survival.

Though there have been numerous studies completed on this broad subject, as can be seen by the many literature citings in this document involving old-growth characteristics and species requirements, there certainly is a need to better understand these relationships. There are numerous studies being conducted in the Pacific Northwest Region, as well as some that will be conducted locally, that will continue to add to this body of knowledge, such as the monitoring plan for the future use of former Bull Creek SOHA as detailed in Chapter II - Alternatives Considered in Detail, Monitoring.

How will the programmed annual sale volume for Rigdon Ranger District and the Willamette National Forest be affected by the large amount of salvage volume sold for this Project?

The volume harvested from the the Rigdon Ranger District will be higher than usual for fiscal year 1989 as a result of the fire salvage but the sale volume for the Willamette National Forest will not increase. On the Willamette, harvests are balanced on a decade basis. Since the Rigdon Ranger District will harvest more than its usual share in 1989, it will harvest less in years to come as a portion of the District's land base will not be available for harvest for about 80 years as a result of the fire. In addition, several other districts that have assisted the Rigdon Ranger District staff in the preparation of this project will apply some of the Shady Beach salvage volume to their programmed annual sale volume. Since there will be some deferred harvest as a result of this changed workload, the programmed annual sale volume for those districts will likely increase somewhat in years to come.

G008
Pg 1 of 7

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REGION 10
1200 SIXTH AVENUE
SEATTLE, WASHINGTON 98101

APR 11 1989

REPLY TO
ATTN OF: WD-136

Michael Kerrick
Forest Supervisor
Willamette National Forest
211 East 7th Street
Eugene, Oregon 97740

Dear Mr. Kerrick:

In accordance with our responsibilities under the National Environmental Policy Act and Section 309 of the Clean Air Act, we have reviewed the Draft Environmental Impact Statement (draft EIS) for the Shady Beach Fire Recovery Project. We submitted scoping comments on this project on November 3, 1988.

The draft EIS includes five alternatives for the recovery of fire effects and salvage of timber killed in the Shady Beach Fire of September 1988. This fire burned 9,163 acres within the Rigdon Ranger District east of the Hills Creek Reservoir southeast of Eugene, Oregon. The preferred alternative includes salvage of 130 million board feet of the 148 million board feet killed in the fire.

In general, we find the Draft EIS represents a conscientious effort to disclose the relevant environmental effects of salvage logging in the project area. We are particularly pleased with the emphasis placed on identification and mitigation of water quality/fishery effects.

Additional information is needed to support the final EIS. This includes documentation for a water quality/fish monitoring plan, which we understand has already been implemented. Also additional information is needed to understand how the project will comply with Oregon Water Quality Standards for turbidity.

Based on our review we have rated the draft EIS EC-2 (Environmental Concerns -Insufficient Information). Our review has identified issues which may require changes to the preferred alterative or application of additional mitigation measures. A summary of our rating system and detailed comments are enclosed.

We are confident that these issues can be resolved as the preferred alternative is developed for the final EIS. We appreciated the opportunity to view the project and meet with project staff in Oakridge on October 26, 1988, and meet again with your staff in Seattle on April 6, 1989.

G008
2 of 7

Please contact Wayne Elson at (FTS) 399-1463 for any questions concerning our comments.

Sincerely,

Robert S Burd

Robert S. Burd
Director, Water Division

Enclosures

cc: ODW
ODEQ
ODF
USFWS
USFS, Region 6
USFS, SBRP

G008
3 of 7

U.S. Environmental Protection Agency
Detailed Comments
Shady Beach Fire Recovery Project
Draft Environmental Impact Statement

WATER QUALITY/FISHERIES

One of the major issues of concern for this project is compliance with Oregon Water Quality Standards (WQS's) for turbidity. The WQS's state that, "No more than a 10 percent cumulative increase in natural stream turbidities shall be allowed, as measured relative to a control point immediately upstream of the turbidity causing activity...(OAS 340-41-445(2)(c))." Turbidity increases greater than 10 percent are predicted for the preferred alternative. The following comments are offered so that EPA and the Oregon Department of Environmental Quality will have a better basis for characterizing environmental effects from sediment and turbidity, potential exceedances of WQS's, and beneficial use impairment.

1. A better understanding of the significance of turbidity can be gained by comparing turbidity levels from action alternatives (post-fire management) with pre-fire management in the basin. On page III-11 the draft EIS states that such an analysis was not conducted. (Pre-fire plus post-fire management compared with post fire conditions were used on the Silver Fire Recovery Project for addressing standards questions).

2. While apparently not considering the pre-fire management the draft EIS states for the preferred Alternative C on page IV-31 that, "Nine Class II streams draining harvested areas are predicted to have turbidity increases during winter and spring flows above the 10 percent in addition to post-fire levels (Figure IV-21). Implementation of Alternative C would result in 35 percent of the analysis area being comprised of subdrainages with potential and designated fish-bearing streams that would have turbidity increases of 10 percent or more." In fact, all of the action alternatives will cause turbidity increases greater than 10 percent for some Class II streams. Changes and/or additional mitigation measures may be needed in the preferred alternative to meet WQS's.

3. It would be useful for us to have more documentation of the process of analysis, modelling, uncertainty, etc. to evaluate the turbidity and temperature levels which are predicted. More specifically, how were the following obtained:

   a. baseline surface and mass erosion rates;

   b. coefficients for various disturbance activities, i.e., harvest logging system, road and landing building, prescribed burning (by season);

G008
4 of 7

c. recovery rates for surface and mass erosion following various types of disturbances;

d. recovery rates for temperature increases relating to shade recovery;

e. effects of the fire by intensity class upon surface and mass erosion;

f. coefficients for sediment delivery to the channel network;

g. description of the process establishing turbidity levels from past suspended sediments measurements (page B-9, Figure 7); and

h. process to compute sediment storage potential within Hills Creek.

4. There is not enough information in the draft EIS to determine what the uncertainty in individual models is and how this uncertainty is propagated through to the final matrix (S-7) of environmental impacts. There are a number of references in the draft EIS to uncertainty (e.g., pages IV-16, IV-22, IV-25, and IV-26). However, the various graphs which are provided to represent impact models (e.g., Figures IV-14, B-2, B-5, B-7) show no uncertainty. In addition, the matrices which quantify environmental impact (pages S-7 through S-10) are presented as if the estimates are significant to three decimal places without mention of variability.

5. An issue related to uncertainty is the similarity of outcomes for maximum temperature, turbidity, and ARP despite the variability in management among the alternatives. This may mean that the fire-related impacts are so great as to overshadow the impacts of management. If so, the final EIS should make this clear. (A useful graphic might be to depict recovery rates with each of the alternatives against Figure IV-8.) It may be true, however, that while the point estimates of the outcomes from the models may lead to similar results, the variability may be different. If this is the case it would be important to make an effort to characterize that variability.

6. One important indicator which appears to be missing from the impact matrices S-7 through S-10 is Large Woody Debris (LWD). A great deal of text is devoted to describing why this is an important indicator for resident fish beneficial uses.

7. It is not clear from the draft EIS which of the subdrainages actually have fish and fish habitat potential. This should be included.

8. Since LWD an important indicator for quality of resident fish habitat in the project area it would be appropriate to discuss its importance relative to turbidity, temperature and pool depth.

9. It would be useful to be able to trace the development of composite percent reduction in long-term recruitment of LWD into the aquatic system. How was Figure IV-22 derived from the table on page B-19?

G008
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10. Another useful table would be to show LWD, temperature, ARP, turbidity and overall resident fish habitat condition for each alternative in individual subdrainages, composite for subdrainages, Hills Creek and Hills Creek Reservoir

11. The draft EIS did not include a discussion of turbidity effects on aquatic life other than fish. Macroinvertebrate and primary production levels during the winter months should be discussed. Macroinvertebrate sampling may be appropriate.

12. Effects from the upper watershed need to be assessed in order to evaluate the project and its contribution to cumulative watershed effects (this was mentioned previously in the evaluation of turbidity.) Aggregate Recovery Percentage (ARP) descriptions have been described for predicted stream flow peak responses from the upper watershed. What is needed is an evaluation of erosion, sedimentation, and turbidity contributions from the upper watershed.

13. A fire intensity map and detailed discussion of the criteria used to define intensity classes is needed. This is important to identify the spatial distribution of the fire and its effects. Were fire intensity classes the same for assessment of fire-killed timber as for watershed effects? How was fire intensity used to develop erosion coefficients for surface and mass erosion?

OTHER COMMENTS

Prescribed burning is planned for most of the units. How will this burning affect the amount of LWD which is left? Is such burning necessary? There should be discussion to weigh the benefits of LWD for long-term productivity against the risk of future losses from fires in harvested units. How will air quality effects be mitigated? Are there opportunities to avoid prescribed burning on some units? Are site productivity losses possible from prescribed burning?

The statement of mitigation for long-term organic matter on page II-7, item 1, mitigation enhancements common to alternatives B, C, D, and F is not clear. Will 2 decomposition Class I or II logs (not cedar) be left or is this related to utilization standards of the operation? Does this mean that if the operator chooses to remove this material, or if there is very little unmerchantable large material, that 2 logs (Class I and II) may not be left on-site? Are 2 logs sufficient to protect long-term organic matter productivity? This should be discussed.

The discussion of long-term site productivity is not sufficiently detailed to provide information about the importance of LWD. It is treated as one component of Total Organic Material yet it is the component most easily managed. The planned activities to conduct extensive prescribed burning in all the action alternatives without discussing effects (page IV-4) seems inappropriate if this component is important to long-term site productivity. Put another way, is it prudent to assume that prescribed burning is acceptable in all action alternatives, when the potential effects to site productivity are unknown?

G008
6 of 7

An assessment of the effectiveness of the mitigation measures to reduce adverse effects common to all alternatives should be made and described.

The discussion of monitoring is not sufficiently detailed to indicate how implementation of a given alternative and mitigation will protect the resources of concern, particularly those identified as issues and concerns. In our discussion with project staff on April 6, it was evident that much more monitoring is presently occurring than is described in the draft EIS. Monitoring is crucial as a feedback mechanism to management to change or adapt management should unacceptable resource effects occur. Monitoring provides the data to assess the effects of the preferred alternative during implementation. Such data would be important to those interested in the outcome of this project.

G 008

7 of 7

SUMMARY OF THE EPA RATING SYSTEM FOR DRAFT ENVIRONMENTAL IMPACT STATEMENTS: DEFINITIONS AND FOLLOW-UP ACTION *

Environmental Impact of the Action

LO--Lack of Objections

The EPA review has not identified any potential environmental impacts requiring substantive changes to the proposal. The review may have disclosed opportunities for application of mitigation measures that could be accomplished with no more than minor changes to the proposal.

EC--Environmental Concerns

The EPA review has identified environmental impacts that should be avoided in order to fully protect the environment. Corrective measures may require changes to the preferred alternative or application of mitigation measures that can reduce the environmental impact. EPA intends to work with the lead agency to reduce these impacts.

EO--Environmental Objections

The EPA review has identified significant environmental impacts that should be avoided in order to provide adequate protection for the environment. Corrective measures may require substantial changes to the preferred alternative or consideration of some other project alternative (including the no-action alternative or a new alternative). EPA intends to work with the lead agency to reduce these impacts.

EU--Environmentally Unsatisfactory

The EPA review has identified adverse environmental impacts that are of sufficient magnitude that they are unsatisfactory from the standpoint of public health or welfare or environmental quality. EPA intends to work with the lead agency to reduce these impacts. If the potential unsatisfactory impacts are not corrected at the final EIS stage, this proposal will be recommended for referral to the CEQ.

Adequacy of the Impact Statement

Category 1--Adequate

EPA believes the draft EIS adequately sets forth the environmental impact(s) of the preferred alternative and those of the alternatives reasonably available to the project or action. No further analysis of data collection is necessary, but the reviewer may suggest the addition of clarifying language or information.

Category 2--Insufficient Information

The draft EIS does not contain sufficient information for EPA to fully assess environmental impacts that should be avoided in order to fully protect the environment, or the EPA reviewer has identified new reasonably available alternatives that are within the spectrum of alternatives analyzed in the draft EIS, which could reduce the environmental impacts of the action. The identified additional information, data, analyses, or discussion should be included in the final EIS.

Category 3--Inadequate

EPA does not believe that the draft EIS adequately assesses potentially significant environmental impacts of the action, or the EPA reviewer has identified new, reasonably available alternatives that are outside of the spectrum of alternatives analyzed in the draft EIS, which should be analyzed in order to reduce the potentially significant environmental impacts. EPA believes that the identified additional information, data, analyses, or discussions are of such a magnitude that they should have full public review at a draft stage. EPA does not believe that the draft EIS is adequate for the purposes of the NEPA and/or Section 309 review, and thus should be formally revised and made available for public comment in a supplemental or revised draft EIS. On the basis of the potential significant impacts involved, this proposal could be a candidate for referral to the CEQ.

* From EPA Manual 1640 Policy and Procedures for the Review of Federal Actions Impacting the Environment

February, 1987

G010

- Pg 1 of 1

DEPARTMENT OF HEALTH & HUMAN SERVICES

Public Health Service

Centers for Disease Control
Atlanta GA 30333

APR 13 1989

April 10, 1989

Forest Supervisor
Willamette National Forest
P.O. Box 10607
Eugene, Oregon 97440

Dear Sir:

We have reviewed the Draft Environmental Impact Statement (DEIS) for the Shady Beach Fire Recovery Project. We are responding on behalf of the U.S. Public Health Service. It is regrettable that such a project is required to repair the effects of a large fire in the Willamette National Forest in 1988. We did find that this DEIS has thoroughly analyzed the pertinent environmental issues and has developed adequate mitigation measures for unavoidable impacts. We feel that the project does not pose any extraordinary risks to workers or to the general public. As with any large project of this scope, we recommend careful enforcement of Forest Service health and safety guidelines to minimize the likelihood of incidents which could impact human health or safety.

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Thank you for sending this document for our review. Please insure that we are included on your mailing list for the FEIS for this project as well as future documents with potential public health impacts which are developed under the National Environmental Policy Act (NEPA).

Sincerely yours,

David E Clapp

David E. Clapp, Ph.D., P.E., CIH
Environmental Health Scientist
Center for Environmental Health
and Injury Control

6011
Pg 1 of 4

March 3, 1849

United States Department of the Interior

TAKE PRIDE IN AMERICA

OFFICE OF ENVIRONMENTAL PROJECT REVIEW
500 N.E. MULTNOMAH STREET, SUITE 1692
PORTLAND, OREGON 97232

April 12, 1989

ER 89/173

Michael A. Kerrick
Forest Supervisor
Willamette National Forest
211 E. Seventh Street
Eugene, Oregon 97440

APR 12 1989

Dear Mr. Kerrick:

The Department of the Interior has reviewed the draft Environmental Impact Statement (statement) for Beach Fire Recovery Project, Willamette National Forest, Lane County, Oregon. The following comments are provided for your use and consideration when preparing the final documents.

GENERAL COMMENTS

The U.S. Fish and Wildlife Service (Service) finds that the draft statement adequately describes fish and wildlife resources and their anticipated impacts. However, the Service suggests the preferred alternative be modified to:

1. Provide for at least 60 percent of the potential cavity nesting bird population (this would be consistent with the policy of the Oregon Department of Fish and Wildlife); and
2. Incorporate the establishment of quality big game forage plots to help offset the reductions in thermal cover.

Spotted Owls

The Service believes the entire Bull Creek spotted owl habitat area (SOHA) should be retained as long as monitoring indicates that spotted owls are utilizing the area. In addition, an alternate SOHA should be established in close proximity to the project area to serve as a replacement for the Bull Creek SOHA if it should ever become unsuitable for spotted owls.

The final statement should address how each alternative would meet the requirements of the spotted owl Interagency Agreement among the Service, the U.S. Forest Service, the Bureau of Land Management, and the National Park Service.

Threatened and endangered species

The draft statement indicates that suitable perch sites for the endangered bald eagles will be retained within 200 feet of the entire reservoir shoreline and the Hill Creek riparian area (Chapter III-36) and that the integrity of the Bald Eagle Management Area to provide potential nest trees for bald eagles in Bull Creek will not be adversely affected (Chapter IV-72).

Since this indicated management direction would be consistent with the Hills Creek Bald Eagle Management Area, the Service could concur with a determination that the proposed project will not adversely affect the bald eagle (Chapter IV-115).

The C.T. Beach arm of the reservoir may also contain potential eagle habitat. Some tree stands on the upper slopes and ridgelines facing the C.T. Beach arm may be within the project area. The amount and availability of specific trees or tree stands with suitable bald eagle habitat characteristics in or adjacent to the C.T. Beach area should be addressed in the final statement. To further the conservation and recovery of the bald eagle, maintaining the potential viability of this area for bald eagles is essential.

The Service also recommends that the Willamette National Forest determine whether the proposed salvage operations may affect potential bald eagle habitat along the C.T. Beach arm of the reservoir. If availability of suitable nesting trees is suboptimal, the final statement should consider development of salvage prescriptions for promoting or improving bald eagle habitat.

SPECIFIC COMMENTS

Page III-37 Threatened, Endangered, and Sensitive Species: The draft statement indicates that the proposed project area has small amounts of cliff habitat which have the potential to provide nesting ledges for the endangered peregrine falcon. The Service recommends that spring inventories for potential habitat be conducted annually to determine the presence of breeding falcons or active eyries. Salvage operations within one and a half miles of active eyries, or in the line-of-sight of active eyries, should be evaluated for their effects to breeding peregrine falcons. Consultation with the Service should be initiated under Section 7 of the Endangered Species Act (Act) if the project may affect peregrine falcons. The Service recommends that the final statement and the biological assessment, if required, include a brief statement of the procedures and/or measures which will be followed to ensure that there will be no adverse impact to peregrine falcons.

SUMMARY

If new information should indicate that the proposed action may affect any listed or proposed species, the Willamette National Forest should be aware of its continuing responsibilities as described in Sections 7(a) and (c) of the Act. For your information and convenience, we have attached a copy of these responsibilities.

The above comments regarding threatened and endangered species have also been provided as part of informal consultation (No. 1-7-89-I-69). If you have any questions regarding these comments or your responsibilities under the Endangered Species Act, please contact Russell Peterson, Field Supervisor; U.S. Fish and Wildlife Service; Portland Field Office: 727 N.E. 24th Avenue, Portland, Oregon 97232; (503) 231-6179 or 8-429-6179.

For additional information regarding the management of existing and potential old growth stands for bald eagles, we recommend consulting an article recently published in the Journal of Wildlife Management. This article, authored by Robert G. Anthony and Frank B. Isaacs, is entitled "Characteristics of bald eagle nest sites in Oregon" (J. Wildl. Manage. 53(1):148-159).

Thank you for the opportunity to review and comment on the draft statement.

Sincerely,

Charles S. Polityka

Charles S. Polityka
Regional Environmental Officer

Attachment

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FY 4:74

FEDERAL AGENCIES' RESPONSIBILITIES UNDER SECTION 7(a) and 7(c) OF THE ENDANGERED SPECIES ACT

SECTION 7(a) - Consultation/Conference

Requires: 1. Federal agencies to utilize their authorities to carry out programs to conserve endangered and threatened species;

2. Consultation with FWS when a Federal action may affect a listed endangered or threatened species to insure that any action authorized, funded, or carried out by a Federal agency is not likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitat. The process is initiated by the Federal agency after they have determined if their action may affect (adversely or beneficially) a listed species; and

3. Conference with FWS when a Federal action is likely to jeopardize the continued existence of a proposed species or result in destruction or adverse modification of proposed critical habitat.

SECTION 7(c) - Biological Assessment for Construction Projects [1/]

Requires Federal agencies or their designees to prepare Biological Assessment (BA) for construction projects only. The purpose of the BA is to identify any proposed and/or listed species which are/is likely to be affected by a construction project. The process is initiated by a Federal agency in requesting a list of proposed and listed threatened and endangered species (list attached). The BA should be completed within 180 days after its initiation (or within such a time period as is mutually agreeable). If the BA is not initiated within 90 days of receipt of the species list, please verify the accuracy of the list with our Service. No irreversible commitment of resources is to be made during the BA process which would result in violation of the requirements under Section 7(a) of the Act. Planning, design, and administrative actions may be taken; however, no construction may begin.

To complete the BA, your agency or its designee should: (1) Conduct an onsite inspection of the area to be affected by the proposal which may include a detailed survey of the area to determine if the species is present and whether suitable habitat exists for either expanding the existing population or for potential reintroduction of the species; (2) review literature and scientific data to determine species distribution, habitat needs; and other biological requirements; (3) interview experts including those within FWS, National Marine Fisheries Service, State conservation departments, universities, and others who may have data not yet published in scientific literature; (4) review and analyze the effects of the proposal on the species in terms of individuals and populations, including consideration of cumulative effects of the proposal on the species and its habitat; (5) analyze alternative actions that may provide conservation measures; and (6) prepare a report documenting the results, including a discussion of study methods used, any problems encountered, and other relevant information. Upon completion, the report should be forwarded to our Endangered Species Team Leader.

[1/] On projects other than construction, it is suggested that a biological evaluation similar to the biological assessment be undertaken to conserve species influenced by the Endangered Species Act.

Attachment A

G004
Pg 1 of 7

NEIL GOLDSCHMIDT
GOVERNOR

Department of Environmental Quality

811 SW SIXTH AVENUE, PORTLAND, OREGON 97204-1390 PHONE (503) 229-5696

RECEIVED
APR 14 1989

April 10, 1989

Michael Kerrick
Forest Supervisor
211 E. 7th Street
P.O. Box 10607
Eugene, Oregon 97440

Re: Shady Beach Fire Recovery Project

Dear Mr. Kerrick:

The Department has reviewed the draft Environmental Impact Statement (DEIS) for the Shady Beach Fire Recovery Project on the Willamette National Forest. We offer the following comments related to water quality impacts of the Project's proposal to harvest timber and related activities within the project area.

The Department's primary concern is that the Project's activities be consistent with Oregon's adopted Statewide Water Quality Management Plan for forest practices as required by the Clean Water Act. We have been in contact with project staff regarding those requirements. We recognize some damage to water quality has occurred because of the fire and do not wish to see further degradation. As acknowledged by the DEIS, the proposed human activities may cause further injury to the beneficial uses of the water if not properly mitigated.

The post-fire, non-managed environment is the base line for our analyses. We believe that temperature and turbidity are two water quality parameters of concern for this DEIS. Our analysis and comments on the DEIS for streams within the project boundary will concentrate upon a determination of the extent, duration, and impact of turbidity and temperature as a result of post-fire activities and assurance that all practicable measures have been incorporated to minimize the effects. While some increase in temperature and turbidity may be allowed over post-fire, non-managed conditions, such increase shall not impact beneficial uses.

The water quality standards for Temperature and Turbidity in the Willamette Basin are:

> "**OAR 340-41-445(2)** No wastes shall be discharged and no activities shall be conducted which either alone or in combination with other wastes or activities will cause violation of the following standards in the waters of the Willamette River Basin:
>
> **(b) Temperature:**

(C) All other Willamette Basin streams:

(i) Salmonid fish producing waters: No measurable increases shall be allowed outside of the assigned mixing zone as measured relative to a control point immediately upstream from a discharge when stream temperatures are 58 degrees F. or greater; or more than 0.5 degrees F. increase due to a single-source discharge when receiving water temperatures are 57.5 degrees F. or less; or more than 2 degrees F. increase due to all sources combined when stream temperatures are 56 degrees F. or less, except for specifically limited duration activities which may be authorized by DEQ under such conditions as DEQ and the Department of Fish and Wildlife may prescribe and which are necessary to accommodate legitimate uses or activities where temperatures in excess of this standard are unavoidable and all practical preventative techniques have been applied to minimize temperature rises. The Director shall hold a public hearing when a request for an exception to the temperature standard for a planned activity or discharge will in all probability adversely affect the beneficial uses.

(ii) Non-Salmonid fish producing waters: No measurable increases shall be allowed outside of the assigned mixing zone, as measured relative to a control point immediately upstream from a discharge when stream temperatures are 64 degrees F.; or greater or more than 0.5 degrees F. increase due to a single-source discharge when receiving water temperatures are 63.5 degrees F. or less; or more than 2 degrees F. increase due to all sources combined when stream temperatures are 62 degrees F. or less, except for specifically limited duration activities which may be authorized by DEQ under such conditions as DEQ and the Department of Fish and Wildlife may prescribe and which are necessary to accommodate legitimate uses or activities where temperatures in excess of this standard are unavoidable and all practical preventative techniques have been applied to minimize temperature rises. The Director shall hold a public hearing when a request for an exception to the temperature standard for a planned activity or discharge will in all probability adversely affect the beneficial uses.

G004
Pg 3 of 7

(c) Turbidity (Jackson Turbidity Units, JTU):

No more than a 10 percent cumulative increase in natural stream turbidities shall be allowed, as measured relative to a control point immediately upstream of the turbidity causing activity. However, limited duration activities necessary to address an emergency or to accommodate essential dredging, construction or other legitimate activities and which cause the standard to be exceeded may be authorized provided all practicable turbidity control techniques have been applied and one of the following has been granted:

(A) Emergency activities: Approval coordinated by DEQ with the Department of Fish and Wildlife under conditions they may prescribe to accommodate response to emergencies or to protect public health and welfare.

(B) Dredging, Construction or other Legitimate Activities: Permit or certification authorized under terms of Section 401 or 404 (Permits and Licenses, Federal Water Pollution Control Act) or OAR 141-85-100 et seq. (Removal and Fill Permits, Division of State Lands), with limitations and conditions governing the activity set forth in the permit or certificate."

When applying the above standards, OAR 340-41-445(3) is also relevant:

> "**OAR 340-41-445(3)** Where the natural quality parameters of waters of the Willamette River Basin are outside the numerical limits of the above assigned water quality standards, the natural water quality shall be the standard."

For the Shady Beach Fire Recovery Project, this means that the post-fire, non-managed conditions predicted for water quality become the standards. For example, the post-fire, non-managed forest conditions and the resulting stream condition for temperature that are predicted become the water quality standards against which the management alternatives and their resulting impacts will be compared.

In addition to these specific parameter standards, the Water Quality Rules contain an antidegradation policy must be considered even if specific parameter standards are not to be exceeded. The most important elements of that policy are described in OAR 3440-41-026(1)(a):

> **"OAR 340-41-026(1)(a) Policies and Guidelines Generally Applicable to All Basins:**

G004
Pg 4 of 7

> Existing high quality waters which exceed those levels necessary to support propagation of fish, shellfish, and wildlife and recreation in and on the water shall be maintained and protected unless the Environmental Quality Commission chooses, after full satisfaction of the intergovernmental coordination and public participation provisions of the continuing planning process, to lower water quality for necessary and justifiable economic or social development. The Director or his designee may allow lower water quality on a short-term basis in order to respond to emergencies or to otherwise protect public health and welfare. In no event, however, may degradation of water quality interfere with or become injurious to the beneficial uses of water within surface waters of the following areas:
>
> (A) National Parks;
> (B) National Wild and Scenic Rivers;
> (C) National Wildlife Refuges;
> (D) State Parks."

The Department's review of the Shady Beach Fire Recovery Project DEIS focused on whether specific information has been provided that would describe the predicted water quality conditions in the natural situation. As we examined individual management alternatives, we looked for specific information which indicated how that management alternative affected water quality conditions predicted in the post-fire, non-managed situation.

The Department reviewed the DEIS using the standards discussed above and has the following comments:

1. Figure III-4 shows pre-fire management related temperature changes by comparing 1978 temperatures to 1988 pre-fire temperatures. Figure IV-11 compares temperatures resulting from Alternative E (No Action) to a pre-fire baseline. It appears that the 1988 managed, pre-fire temperatures were used as the pre-fire baseline in figure IV-11, and that the managed, post-fire temperatures were used as a baseline in figures IV-16, and IV-19. As mentioned above, DEQ considers the post-fire, non-managed condition the baseline. In other words, the increases due to pre-fire management shown in figure III-4 should be subtracted from the post-fire conditions to arrive at the baseline natural conditions by which to compare temperature increases.

   This does not mean the project must be managed to achieve temperature or turbidity below current levels. This may well be impossible in some basins. Current temperatures should also be displayed. Where they are above the maximum standard, no measurable increase shall be allowed. Where the current temperatures are below the maximum temperature standard, the post-fire, non-managed temperature must be considered when applying the standards. In either case, the impact on beneficial

G004
Pg 5 of 7

uses should guide management decisions. Where it can be shown that no fishery would be affected by temperature increases, (including downstream fisheries), the Department may consider temporary exceedences of the standard. Since no measurable increases are predicted for the preferred alternative, this additional analysis probably will not result in any changes to the project.

2. The DEIS predicts less than 1 degree F. temperature increase in Hills Creek due to the fire and predicts insignificant effects on fish. It estimates temperature will recover in about 7 years. A discussion of predicted increases due to pre-fire and post-fire management similar to that provided for the Class II streams, is needed for Hills Creek, the only class I stream in the area.

3. Turbidity should also be analyzed using the post-fire, non-managed condition as baseline. Turbidity increases from both the pre-fire management and post-fire management taken together should be less than the standard, 10 percent.

4. Alternative C predicts a 2 percent increase in turbidity in Hills Creek Reservoir due to post-fire management. Although the DEIS does not provide an estimate of increased turbidity for Hills Creek itself, our understanding from discussion with project staff is that the increase would be less than 10 percent. This should be stated more clearly in the final document.

5. The DEIS predicts nine class II streams within the project area would have turbidity increases above 10 percent during winter and spring flows due to post-fire management under alternative C. It further states that 35 percent of the analysis area would be "comprised of subdrainages with potential and designated fish-bearing streams that would have turbidity increases of 10 percent or more." The DEIS states that of the 11 Class II drainages with fish-bearing potential, only four have confirmed occupancy by fish, and that two streams classified as Class III have been found to contain fish. Our understanding from talking with project staff is that blockages prevent fish passage on all but two of the Class II streams (Landes and Mike Creeks), and even those are blocked a few hundred feet from their mouths. It is unclear whether the 35 percent refers to the drainage area of just those two streams, or to streams that could provide fish habitat if the blockages were removed. It is important to clarify the use of each stream by fish in order to evaluate impact on beneficial uses from the predicted changes in temperature and turbidity shown for each stream. Which of the fish bearing streams, if any, exceed 10 percent increase in turbidity? Or should we assume all of the Class II streams do have a fishery?

G004
Pg. 6 of 7

6. The DEIS states that the turbidity estimates are based on a flow of 140 cfs in Hills Creek, but are valid for flows above 100 cfs. It further states that flow is above 100 cfs 68 percent of the time from November to January. As discussed with project staff, it would be helpful to state the flow rate and recurrence interval whenever turbidity is discussed. The Department needs to know the intensity and duration of turbidity events and the impacts on the beneficial uses from those events.

7. Figure IV-8 shows a hypothetical sediment yield through time, predicting a peak in four to ten years falling to near pre-fire rates in about 30 years. Since turbidity is closely correlated to sediment yield, we assume it would have a similar response in which it would return to previous levels in about 30 years.

8. The DEIS predicts little effect on spawning gravels from suspended sediment, and an insignificant contribution to Hills Creek Reservoir storage capacity. It states that most sediment would pass through the system in winter high flows, and that all of the stored sediment is expected to be flushed from the system in 5 to 10 years.

9. Where management activities are predicted to cause more than a 10 percent increase in turbidity in any fish-bearing stream, DEQ expects water quality in that stream and the impact on the fishery to be closely monitored. The final EIS should discuss what mitigation measure would be taken if an impact on the fishery is indicated. These measures may include removing a barrier in a potential fish-bearing stream if the fishery would be comparable.

10. The Department recognizes that stabilization efforts such as seeding have been implemented since the fire that are not accounted for in the model. Other factors also make the predictions somewhat uncertain. The predicted impacts are shown as single values. It would be helpful the level of uncertainty in the models was somehow portrayed.

11. It is our understanding that the monitoring plan for the project is a separate document, not included in the DEIS. Although we have not yet received or reviewed the monitoring plan, we feel monitoring is an essential part of the project. We believe monitoring is extremely important for four reasons: 1) Monitoring can ensure that water quality and beneficial water uses are not degraded. Practices can be modified if predictions are exceeded. 2) Water quality and beneficial use data can also be used to evaluate best management practices employed within the project area. 3) Monitoring can verify the model predictions for temperature, sediment and turbidity for future modeling efforts in the forest. 4) Results of the monitoring can help evaluate future activities in other burn areas.

G004
Pg 7 of 7

Through conversations with project staff we were pleased to learn that monitoring has already begun, and that it appears quite extensive. We would appreciate receiving a copy of the monitoring plan and to be kept abreast of the monitoring results.

12. Communication between the Forest and Project staffs is vital relative to water quality protection. We recommend that:

    a. Commitments for water quality protection be reflected in timber sales contracts. It is important that the project staff ensure that the timber sales accurately reflect strict specifications for water quality protection during road design, construction, maintenance, and timber harvest.

    b. Results of water quality monitoring not only appear in an annual report but that the monitoring staff also meet frequently with the appropriate supervisors and timber sales contract administrators. These meetings should ensure timely review of the results of the implementation and effectiveness monitoring. We believe that these meetings should be an integral part of the forests commitment to water quality protection.

If you have questions regarding these comments or other water quality concerns, please contact Nancy Lillquist (229-5878).

Sincerely,

Richard J. Nichols
Administrator
Water Quality Division

RJN:hs
PM\WH3345 (NNL)

cc: Cathy Barbouletos, Project Director
Hal Legard, Willamette National Forest
Stephen Sorseth, Willamette National Forest
Wayne Elson, Environmental Protection Agency
Alan Smart, Environmental Protection Agency

G006
PAGE 1 OF 2

NEIL GOLDSCHMIDT
GOVERNOR

Department of Fish and Wildlife
NORTHWEST REGION
ROUTE 5, BOX 325, CORVALLIS, OREGON 97330-9446 PHONE 757-4186

April 5, 1989

RECEIVED
APR 11 1989

Michael A. Kerrick
Forest Supervisor
Willamette National Forest
211 E. 7th Street
Eugene, Oregon 97440

Dear Mike:

We have received and reviewed the Shady Beach Fire Recovery Project DEIS. The Northwest Region appreciates the opportunity to be involved with the interdisciplinary team on this project. We would also like to commend your agency for it's prompt seeding of the area following the fire; these actions undoubtedly have resulted in a reduction of soil erosion and a protection of water quality and fisheries values.

We offer the following comments for your consideration as you develop a final management plan for this area.

WILDLIFE

During ODFW's involvement in the interdisciplinary planning process there were four clearcut units identified for wildlife forage enhancement. These units contained 80 acres, or about one percent of the analysis area, which were to be seeded and fertilized with an improved forage mix. Areas adjacent to these identified acres were to be utilized as control plots for silvicultural concerns. The control areas were designed to evaluate the effects of the forage mix on tree growth and survival.

The purpose of this management proposal was threefold 1). to mitigate for the loss of thermal cover in winter range areas, 2). to improve the forage quality in spring calving areas, and 3). to test forage seed mixes for use on Cascade forests.

The absence of this proposal in the DEIS alternatives may be an error by omission. We strongly urge that this mitigation proposal be included in the final alternative.

We urge you to use the following direction in the Shady Beach Recovery Project. These comments are consistent with those we have submitted for your use in the Proposed Land and Resource Management Plan DEIS.

GOCC
PAGE 2 of 2

The mitigation and enhancement techniques common to alternatives C,D and F, in the Recovery Project DEIS, are to be commended. Consistent with our input to the Forest Plan DEIS, however, for dead and down and for snags respectively we request "six logs per 10 acres averaging 24 inches in diameter and 40 feet long --", and that you "sustain snag dependent wildlife species at 60 percent of potential ----" as a management goal in this area. This would enable the USFS to comply with the statement in the Forest Plan DEIS which says that "salvage logging after catastrophic losses from windthrow or fire will be done in a manner that enhances wildlife value".

We strongly concur with the recommendation to replace the existing SOHA with an alternate site. However, the degradation of the SOHA within the analysis area does present a unique opportunity to monitor the effects of a catastrophic event, which you may want to consider doing.

FISHERIES / WATER QUALITY

Again, you are to be commended for your prompt seeding after the fire which helped control soil erosion. However, we are still concerned with the amount of acreage with a high soil rating that is proposed for harvest. For example, in the Proposed Forest Plan DEIS the Hills creek drainage is ranked #8 in the sensitivity index. Because of this sensitivity we ask that you use the water quality and fish habitat protection measures contained in alternative F of the Recovery Project DEIS. We also ask that buffers be provided on class IV streams unless it is demonstrated that such protection is unnecessary to protect downstream water quality and fish habitat.

Harvest units 5264, 5270, 5420, 5422 and 2206 are on bare rock or shallow soil on very steep (70-100%) slopes directly along Hills Creek. Much of this area is not burned. Units 5264 and 5270 should not be harvested below the ridge-line, and portions of the other three units within one-quarter mile of Hills Creek or on unstable soils should also remain unsalvaged to prevent accelerated erosion.

We request that the you continue the current excellent level of coordination and consultation with our local fish and wildlife biologists, as planning progresses, to insure that wildlife habitat effectiveness, water quality protection, and fish habitat protection and enhancement measures are considered on all harvest units. Thanks for this opportunity to work together and comment on the DEIS.

Sincerely,

Dick Lantz

Dick Lantz

cc: Wheeler Castillo Ingram Wagner/DeHart
Anderson Cleary MacHugh/Carlson
Hutch Bruce Ingram/Greer

Received in SC
4-11-89 mo

G007
Pg 1 of 9

1859
NEIL GOLDSCHMIDT
GOVERNOR

Forestry Department
OFFICE OF STATE FORESTER
2600 STATE STREET, SALEM, OREGON 97310 PHONE 378-2560

April 10, 1989

Michael A. Kerrick
Forest Supervisor
211 E. 7th Street
P.O. Box 10607
Eugene, OR 97440

Dear Supervisor Kerrick:

The Oregon Department of Forestry compliments you and your project team on the timely completion of the Shady Beach Fire Recovery Project Draft Environmental Impact Statement (DEIS).

We are especially pleased with the ongoing preparatory work to facilitate the implementation of recovery actions when the final alternative is selected. Efforts by the project team to inform and involve interested parties are noteworthy, and they have contributed greatly to the success of this project.

As you know, the state depends on the Willamette National Forest for resources critical to Oregon's economy and environment. A fire the magnitude of the Shady Beach Fire results in losses to both the economy and the environment. To minimize these losses, a comprehensive recovery program, which can be implemented in a timely manner, is essential to salvage as much economic value as possible, while managing the environmental impacts of both the fire and salvage operation. Returning the fire area to a fully productive condition as quickly as possible is important to all Oregonians.

The department's objectives for the recovery of the fire area are fourfold. First, the recovery should be environmentally sound. This objective requires measures that mitigate the impacts of both the fire and the proposed timber salvage operations to environmentally acceptable levels. Second, the salvage should seek to recover the maximum amount of wood fiber economically feasible, consistent with the first objective. Third, lands currently allocated for timber production should be returned to full production as quickly as possible. Finally, potentials for fire reburn, and insect and disease infestations should be reduced to low levels.

G007
pg 279

The Department of Forestry has reviewed the DEIS and the five proposed alternatives. Our attached comments focus on our objectives listed above and hopefully will lead to an improved final EIS and the selection of a "best" alternative.

If you have any questions with regard to the Department of Forestry's comments, please contact Ted Lorensen, Policy Analyst, at 378-5033.

Sincerely,

James E Brown

James E. Brown
State Forester

JEB:tll
Enclosure

G007
Pg 3 of 9

DEPARTMENT OF FORESTRY COMMENTS ON SHADY BEACH FIRE RECOVERY PROJECT DEIS

SIGNIFICANT ISSUES

The DEIS analyzes the alternatives against several significant issues (of concern to involved publics) which were identified during the planning process. The summary lists six significant issues. In Chapter 1, pages 1-6 to 1-7, Issues, Concerns and Opportunities, a seventh issue is added; Cumulative Affects. Further explanation of the need to review this issue is suggested and key indicators should be identified.

Additionally, though this issue is dealt with in the text of the DEIS, it appears to us that the issue of reburn potential/fire control should be added to the listed issues. This issue was expressed as a concern by numerous participants at the December 8, 1988 public meeting in Eugene to identify the range of alternatives to be considered in the DEIS. The issue is of significant concern to the Department of Forestry and adjacent and nearby private forest landowners.

COMPARISON OF THE DEIS ALTERNATIVES WITH THE BASIC OBJECTIVES OF THE BOARD OF FORESTRY'S FORESTRY PROGRAM FOR OREGON

The Forestry Program for Oregon (FPFO) is the policy statement and program of the Oregon State Board of Forestry which addresses current issues on management and allocation of Oregon's forest resources. The FPFO addresses both intensive management practices on Oregon's commercial forest land and balanced uses of all forest lands. The Board of Forestry adopted several policies in the FPFO to offset the continuing decreases in the available commercial forest land base and continuing decreases in the proportion of commercial forest land allocated to full intensive management. The FPFO supports:

1. The application, to the maximum extent silviculturally and economically feasible, of the full range of intensive management practices on all commercial forest land suitable and designated for timber production;

2. Policies and actions which produce a high level of sustainable timber harvest;

3. Sustained yield programs which help ensure community stability and promote orderly economic change; and

4. The maintenance of the maximum commercial forest land base consistent with other resource uses.

Alternatives D, F and E do not meet the Forestry Program for Oregon timber management and community stability goals identified

G007
Pg 4 of 9

above, nor do they meet the other identified objectives of the Department of Forestry for the recovery area.

Alternatives B and C generally meet the Forestry Program for Oregon timber management goals while exceeding Oregon Forest Practices Rule standards (acceptable environmental constraints).

Alternative C does not meet the FPFO goal for community stability. While the overall harvest from the Willamette National Forest will not be reduced by the selection of an alternative, use of higher cost logging methods in Alternative C will reduce the return of timber payments to local government. The difference between Alternative B and Alternative C of at least $600,000 in county revenues during the next two years, may significantly impact Lane County local government. Differences between the two alternatives in number of local community jobs and wage income is also significant.

The five alternatives analyzed in the DEIS followed "themes". Such an approach has failed to consider alternatives which may share "themes". For example, why not analyze an alternative that meets the direction of the current (1977 Willamette National Forest Plan) in terms of land allocation, but includes some (more desireable?) standards and guidelines contained in the Draft Willamette National Forest Land and Resources Management Plan/DEIS. Such an alternative would provide an opportunity to mitigate some of the environmental concerns (about Alternative B) that apparently lead to the choice of Alternative C as the preferred alternative.

Alternative B will provide the most benefits to the statewide and local economies through increased timber harvesting and processing. If Alternative B environmental impacts can be reduced through additional mitigation measures, such measures should have been considered and compared with the other alternatives.

ECONOMICS

Much of the information about the economic analysis was not included in the DEIS; most of the information was available in background papers available from the Forest. The information should have been included in the DEIS to facilitate review.

Different estimated growth losses are provided for each alternative, but information was not provided on the impact of growth loss on future ASQ of the Willamette National Forest. What ASQ will be forgone under each alternative and when will the impact be felt?

Shady Beach DEIS
4/10/89

The assumption stated in Chapter IV, page 104(4), is inconsistent with the proposed Willamette National Forest Plan. Revenues realized in future green tree sales are increased at an annual rate of one percent in the Forest Plan, rather than held constant as in the DEIS.

The stumpage values and millpond values which were used in modeling and estimating monetary impacts appear to be far too low. Since the analysis is trying, in large part, to model current conditions, it is important to consider current values and trends. Stumpage values in the Oakridge timber-shed appear to be currently higher than the values used in the DEIS and lately, stumpage values have been increasing significantly.

Conversely, the project costs assigned to reforestation and fuel treatment appear to be significantly higher than those of other ownerships.

Revenue and cost assumptions affect the estimates of present net value, and estimates of payments to the federal treasury and local governments. The effects of using too low stumpage values/millpond values and too high project costs is to compress the differences between the NPV and federal/county revenues of the various alternatives. The Department of Forestry suggests that you re-examine revenue and cost estimates in estimating economic impacts.

In Chapter IV, page 107(4), Jobs and Income Dollars Generated from Salvage Sales - It appears that logging jobs may have been missed in calculating job impacts. Logging jobs are indirect jobs in IMPLAN, and indirect and induced jobs were apparently not included in the DEIS economic analysis.

The respective hourly wages assigned to the four job classes (page 108) are meaningless. Total employe benefits should have been used. Employe non-wage benefits are significant for most sawmill and plywood plant employees, and for Forest Service employees.

There is no consideration of the economic impacts outside the local area. Consideration of statewide impacts such as state income tax generated by each alternative would be valuable.

VISUALS
The DEIS states that none of the alternatives will meet the visual quality objectives for the analysis area. Modification of the visual allocations in the selected alternative is recommended by the Department of Forestry to reduce the impact on the amount of timber which can be salvaged.

G-oc7
Pg 6 of 9

Maintaining the characteristic vegetation in important viewsheds contributes to the overall attractiveness of the forest and to the recreational experience of the forest visitors. However, the visual values which should be maintained after a forest fire are difficult to determine. Since the characteristic vegetation of the fire area has been significantly modified by the fire, the Department of Forestry believes that minimization of the visual quality recovery period should be the main visual quality objective for the analysis area.

Minimization of the recovery period can best be accomplished by prompt harvest and rapid reforestation. Use of high quality planting stock can help ensure success.

WOOD DETERIORATION

Douglas-fir and grand fir are listed as major components of stands on south-facing slopes (approximately 50 percent of the burn area).

However, references on wood deterioration in appendix C only address decay in Douglas-fir. Grand fir is much more susceptible to decay than Douglas-fir and substantial volume loss will occur in grand fir timber within two years without salvage. Stands with a substantial amount of grand fir should be high priority for early salvage.

INSECT INFESTATIONS

Chapter I (page 3) states that, "...there is a possibility that, over time, the dead trees could result in a buildup of forest pest populations, such as cambium-girdling and wood-boring insects, that could damage nearby healthy stands." Appendix C discusses the potential, based upon historical events, for such insect buildups. However, analysis of the probability and consequences of such insect buildups occurring for the various alternatives is totally lacking.

Clearly, the greatest risk of Douglas-fir beetle activity is in old growth stands damaged by fire, but not salvaged. The Forest Service needs to monitor Douglas-fir beetle activity in unsalvaged stands and retain the option to salvage if green tree mortality occurs.

FIRE AND FUELS

The environmental consequences discussed related to fire and fuels is inadequate in several areas. Only brief discussion of possible increased risk of fire ignition is mentioned. The experience of the Department of Forestry is that large "snag

G-007
Pg 7 of 9

patches" have a much higher risk of lightning ignitions than an area mostly free of snags.

Oregon's fire prevention rules have for years required the removal of snags during forest operations to reduce, in part, this risk. An analysis or discussion of the probability of increased lightning ignitions should be done for alternatives E and F.

Page IV-59 references the Tillamook and Yacolt (not Yacott) fires as examples of reburn fires. The authors are in error in their discussion as it relates to the Tillamook Fires and Alternative E. The original Tillamook fire occurred in 1933 and was caused by logging activity. Subsequent fires occurred on a six year interval (1939, 1945 and 1951) and burned in and were spread principally by snags. Spread generally occurred from snag to snag and made "control actions extremely difficult". Only after snag removal was complete did fire control efforts become effective in the Tillamook Burn.

The discussions of fuel loadings and fire behaviors for Alternatives E, D and F are inadequate because the significant role that snags would play in the spread of fire is not addressed, especially the snag to snag spread such as occurred in the Tillamook Fires. This spread is independent of the surface fuel loading (predicted fuel model). Due to the snags, the fuel models discussed would almost always under-predict the rate of spread and difficulty of control. It is our opinion that standing snags would have a significant impact on fire behavior for over twenty years if these alternatives were chosen.

AIR QUALITY

In Chapter III, pages 21 - 22, and Chapter IV, pages 38 -39, air quality and the impacts of the various alternatives on air quality are discussed. These two sections need to be rewritten to reflect the following information:

1. The Oregon Department of Forestry (not DEQ or LRAPA) regulates the burning of logging slash through the Oregon Smoke Management Plan;

2. The purpose of the Oregon Smoke Management Plan (SMP) is to minimize visual and health effects in areas designated by the State as smoke sensitive areas.

3. No amendments are made by the State to the Clean Air Act.

4. The SMP was also developed as part of the Oregon strategy to meet federal visibility protection requirements in Class 1 Areas.

G007
Pg 8 of 9

5. Prescribed burning may occur during the summer, it is just more restricted. The SMP specifies that prescribed burning has additional restrictions when done between the Fourth of July and Labor Day to minimize visual impacts in Class 1 Areas designated by the State as being impacted by smoke from burning.

6. Air quality in Oakridge is alternatively described as "occasionally exceeding" or "often exceeding" air quality standards. It can't be both!

7. Burning is allowed based upon tonnage, elevation, spacing and timing - not acres.

In addition to the modifications suggested above, an analysis needs to be done comparing total tons of slash to be burned under each alternative versus opportunity to burn under the Oregon Smoke Management Plan for the Shady Beach area. While the total tonnage burned on the Willamette National Forest over the next three to five years may not be increased due to any of the proposed alternatives, more units may need to be burned in closer proximity (to the Oakridge area) than would normally occur. Spacing and elevation restrictions should be reviewed.

SAFETY

While recovery efforts have already been implemented to reduce the risk of injury to the public and forest workers from falling snags along forest roads, the Department of Forestry believes some analysis of risk of injury should be conducted for each alternative. This analysis should consider the risks created for forest workers and the public under each alternative. It appears to the Department of Forestry, that some of the alternatives may result in significant risks to the forest worker and public. This analysis should look at long term, as well as short term, risks.

SUMMARY/CONCLUSION

The Department of Foresty's four objectives for the recovery of the fire area are not met by any of the five alternatives.

For the recovery to be environmentally sound, measures that mitigate the impacts of both the fire and the proposed timber salvage operations to environmentally acceptable levels must be implemented. However, the different "themes" used for the five alternatives arbitrarily establishes different levels of mitigation for each alternative. Why can't more of the mitigation measures, especially those measures related to water quality and Streamside Management Units, be shared by all the alternatives?

G007
Pg 9 of 9

The Department of Forestry believes the salvage should seek to recover the maximum amount of wood fiber economically feasible, consistent with the first objective. This second objective needs to be considered along with the Forestry Program for Oregon policy of ensuring community stability and promoting orderly economic change. Alternatives D, E and F all result in unacceptable social/economic losses.

Third, lands currently allocated for timber production should be returned to full production as quickly as possible. The choice between Alternative B and Alternative C, is a choice between the land allocations and resource objectives of the existing Forest Plan or the proposed Foret Plan. Regardless of which land use allocation plan is used, failure to return these lands to full production as would occur in the other alternatives, will only compound the timber volume and reproduction losses resulting from the fire.

Potentials for fire reburn, and insect and disease infestations should be reduced to low levels. Only Alternatives B and C provide adequate reductions of future fire reburn potential. There are no provisions for monitoring insect activity. This is a serious oversight, especially if the reduced or no harvest alternatives are selected.

While the Department of Forestry understands the desirable decision of only addressing alternatives that meet or exceed the current or proposed Forest Plans, realistic appraisals of social/economic costs, fire risk, insect outbreak risk and public safety risk should indicate that such an approach doesn't make sense for the recovery area. It is the Department of Forestry's opinion that foregoing some of the current or proposed plans' objectives is needed to offset the potential impacts of the fire. Consideration of more creative alternatives is encouraged.

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G009
Page 1 of 10

Department of
Fisheries and Wildlife
College of
Agricultural Sciences

Oregon State University

Corvallis, Oregon 97331-3803 (503) 754-4531

11 April 1989

Mike Kerrick, Forest Supervisor
211 E. 7th Street
P.O. Box 10607
Eugene, OR 97440
Attn: Shady Beach Recovery Project

Dear Mr. Kerrick and Shady Beach Recovery Project team:

Enclosed please find our comments on the Draft Environmental Impact Statement for the Shady Beach fire. We thank the Willamette National Forest and the Project for allowing us to offer suggestions. Our primary areas of expertise and concern is with riparian areas and fisheries management. Consequently, we will confine most of our remarks to these portions of the DEIS. In addition, we generally will not comment on the particular Alternatives presented in the document, but instead will address broader management issues.

We would like to compliment the members of the Recovery Project team responsible for the sections dealing with wildlife issues. These individuals have thoroughly and capably assessed wildlife needs. The scope and depth of their analysis far exceeds anything we have seen for other Forest or Project plans from this region. We hope the managers and decision-makers pay close attention to their analysis and use it as a basis for sound, long-term management policies.

Another general comment concerns the lack of information at various critical points in this document. Given the use of a GIS, it is disappointing to see a lack of spatially arrayed information within the DEIS. For example, nowhere (at least that we could find) are any data presented on fire intensity and the resultant post-fire condition of stands or riparian areas, even for the individual subbasins. We have no means of knowing whether particular areas had only underburn or were totally vaporized. In fact, much of the area, particularly the unharvested stands, may have suffered only moderate underburn and did not crown out. Salvage and/or harvest of timber in these situations will obviously not be as necessary as those areas that suffered more intense burn. This type of landscape level information is crucial, omission of these data is a serious flaw in the DEIS.

G009
Page 2 of 9

RIPARIAN AREA ISSUES

We applaud the use of subbasins for the analysis, not only of riparian areas, but also for the rest of the management objectives. However, in many instances, the general analysis needs to be taken one step further by merging the subbasin information into a landscape perspective. The needs for such integration will be clarified in our comments on cumulative effects and fragmentation. As a result of this lack of integration, clear objectives for basin-wide management of riparian areas are not included. The Shady Beach team needs to consider the desired future condition of riparian areas before plotting their management.

In our comments below, we will address the following issues as they pertain to riparian areas:

Sediments
Water Temperatures
Large Woody Debris
Fisheries
Wildlife
Recreation and Economics
Silviculture
Cumulative Effects
Forest Fragmentation

SEDIMENTS

In the DEIS of the Proposed Land Resource and Management Plan for the Willamette National Forest, both Hills Creek and Middle Fork of the Willamette watersheds are listed as having a high watershed sensitivity index. This measure integrates natural erosion rates, stream density, peak discharges, and area likely to suffer rain-on-snow events. In addition, in the Shady Beach DEIS, there are numerous references to the frequent occurrence of oversteepened slopes, the high mass-wasting potential of the soils, and the increases in discharge predicted even for small steep draws that usually have little or no flowing water. These parameters, combined with the effects of the fire, would result in significant increases in soil erosion rates and in stream sediment loads even if no salvage were to occur. The DEIS also points out that there are even greater risks of soil surface erosion and mass-wasting due to road construction, increases in the number of stream crossings, and harvesting on unstable soils. Much of this soil movement occurs on slopes adjacent to streams or headwalls or as the result of stream channel erosion.

There are several statements in the DEIS suggesting that increases in sediment load, except for catastrophic debris torrents, are not a problem for fish, because most of the increase will be during winter high flows when salmonids do not spawn. However, increases in sediment load may inflict significant damage to fragile gill tissues of fish, which may in turn lead to increases in mortality rates; this process would certainly be important during winter flows. Increases in sediment load during spring or summer months, when salvage activities would be greatest, would have significant impacts on fish and stream invertebrates and periphyton as well. In addition, although fish do not spawn during winter floods, sediment may be deposited in the spawning gravels and stay there, causing mortality of eggs and emerging fry. We have observed cutthroat trout spawning in early March in the McKenzie drainage; certainly danger of high flow (with potential high sediment loads) is by no means over then. Our analysis of the unstable Middle Santiam drainage indicates that increased sedimentation greatly decreases fry survival.

Given all of these "red flags" raised by members of the Project and the importance of riparian areas to providing good water quality, the management team might want to be conservative in their salvage methods. For example, even the preferred alternative predicts a 125% increase in the number of road crossings on Class III and IV streams. Because these streams are the most likely to fail (see above), particularly where they have been severely burned, options such as helicopter logging or wider no-entry, no-salvage buffers of at least 100 feet should be adopted on all of these streams. In addition, harvest on units with high or very high soil erosion ratings (2,061 acres under the preferred alternative) should be strongly reconsidered where these units impinge on streams.

WATER TEMPERATURE

The Project team recognizes the importance of maintaining low stream temperatures, and points out that increases in temperatures may be expected on the most severely burned streams. However, because of the lack of data on the location of the relative burn intensities in the different drainages, it is difficult to evaluate the impacts of both the fire and the salvage operations. Although there are some pre-fire data from the analysis area, the management team should strongly consider basin-wide monitoring of water temperatures over the next several decades. This means more than merely recording maximum summer temperatures in a few selected reaches. Continuous temperature data from all classes of perennial streams, and particularly from tributary junctions, should be gathered. In addition to providing information on stream temperatures, such a system could provide early indications of cumulative effects for the entire basin.

LARGE WOODY DEBRIS

The Project team is to be congratulated on their recognition of the importance of large woody debris (LWD) and their attempts to plan for both its short-term and long-term inputs into all stream classes. We do have some suggestions for LWD management.

First, the definition of LWD (in the glossary) is limited to "all or portions of tree stems, roots or branches that enter a stream channel...(and are)...stable and remain in place..." No mention of minimum size, either diameter or length is made. Under "large woody material," (LWM) dimensions of at least 20 inches diameter on the large end and 40 cubic feet volume are given. We hope that this definition of LWM approaches that of LWD. Using the actual diameter is helpful, volume does not adequately represent the necessary functions. The length of the wood in relation to stream channel width is crucial; wood pieces shorter than channel width will have a greater tendency to move downstream. In the riparian management guides recently generated for the WNF, we recommended a minimum size of 20 inches in diameter and 30 feet in length for LWD.

Second, given the importance of LWD to water quality, soil stability, and fish and wildlife habitat recognized throughout the DEIS, the SMU no-salvage buffers recommended for Class I, II, and III streams will be too narrow. Salvaging dead timber from the outer 25-50 feet of the 100 foot SMU will result in deficiencies in LWD loading over both short and long term. Recent studies (McDade et al, 1989) have demonstrated that a 100 foot buffer is required to maintain 90% of the LWD inputs in undisturbed streams. Examination of the table in Appendix B (B-19) reveals that under the preferred alternative, there will be significant declines in LWD inputs over the no-action (baseline) alternative. We recommend that the Project adopt a minimum 100 foot no salvage, no harvest buffer for all perennial streams. This would maintain approximately 90% of the LWD, both short and long-term inputs. The reductions in LWD inputs on Class IV streams are very high. In intermittent (flowing 9 months or more) or unstable Class IV drainages, LWD can be crucial to soil stability during winter flows. We applaud the 50 foot no harvest buffer on the few Class IV's in high mass-wasting areas; however, we feel similar buffers should be established on intermittent Class IV's as well. In addition, the streamside zones established along Class IV's should not be subjected to stream channel clean out of LWD.

Third, the DEIS mentioned at several points that Hills Creek itself is deficient in LWD as a result of past floods and practices. If there are significant accumulations of wood in the reservoir, the Project team might want to consider collecting the logs, hauling them upstream along Hills Creek, and "re-releasing" them at points where they will benefit stream structure.

FISH

Within the DEIS, relatively little mention is made of what species or stocks of fish occur within the Project area. Statements are limited to mention of species that occur in the reservoir and in "the stream systems." No information is provided on what occurs where or even data on relative abundances. The surveys performed appear to have been limited to Class II and III streams (presumably by electrofishing). Interestingly, fish were found on some on the Class III streams, suggesting the Project needs to do some reclassification of these streams; for appropriate protection of fish-bearing streams.

Unfortunately, no survey appears to have been conducted in Hills Creek. Because this is a recreational fishery of some importance (see ODFW stocking records), a fish survey (even by snorkeling teams) is essential. Also, the bull trout is listed as a Sensitive species by the U.S. Fish and Wildlife Service; thus, Hills Creek should be surveyed to check for the presence of this species. Until more is known about fish populations in Hills Creek itself, salvage/harvest activities along Hills Creek (such as Unit 5264) should be delayed. Many of the units directly adjacent to Hills Creek appear to be very steep (>70%) and on thin, shallow soils. Activities in these units could have an immediate, detrimental effect on the fish populations in Hills Creek.

The Project team is to be congratulated for recognizing the importance of large woody debris (LWD) to fish habitat. We do question the quantitative extrapolation of which LWD amounts into fish production (Chapter IV). The DEIS makes several statements such as "stream buffers with moderate, long-term potential for LWD input will provide 50 percent of the potential pool habitat...provided in an unmanaged stand" and "if 50 percent of the potential for LWD was lost, then the effect would be a potential loss of 15 to 20 percent of the pool habitat." This analysis continues on to translate this into actual numbers of fish that would be lost under such a scenario. While we agree that loss of LWD inputs will ultimately mean loss of fish production, we doubt that the purported accuracy and precision of such predictions are warranted. In our own research, even with very large and long-term studies of fish and LWD, we would be unable to make such predictions. Attempts to predict fish abundances to the nearest hundredth of a decimal are both misleading and falsely accurate. Recognition of the general relationships should be sufficient justification for developing riparian management plans.

A second problem with this type of analysis is the assumption that the only good habitat for fish is pools. While pools are certainly important, particularly for adult trout, they do not necessarily provide the critical areas necessary for rearing fry or young trout. These age classes require side channels, complex lateral areas, backwaters, quiet edges, and even riffles with small pocket pools. Streams with large numbers of pools but no refuges for fry or young fish will have poor fish production. Riffles and rapids provide much of the invertebrate food supply for salmonids. Also, during winter high flows, pools do not necessarily provide escape for fish. Instead, areas such as those listed above will be used as refuges during floods. Woody debris is particularly crucial in both these rearing and refuge areas. The Project should avoid attempts to be overly quantitative by translating LWD inputs to pool density to fish abundances.. Managing for long-term habitat complexity, through LWD inputs at pre-harvest levels in all portions of the stream channel, will result in better fish habitat. While floodplains are evidently uncommon in this basin, managers should take every opportunity to avoid harvest/salvage activities in these areas. Floodplains frequently have complex, braided stream channels which, if protected, can provide excellent habitat for fish.

Finally, there is no systematic, *basin-wide* analysis of fish habitat (including LWD) and numbers. Clearly, there has not been sufficient time since the fire to perform one. However, we strongly urge the Project and the WNF to consider such a survey in the immediate future. Such a study, along the lines of the Hankin-Reeves methodology, currently in use elsewhere on the WNF could be funded from K-V sources and could provide a baseline for further long-term monitoring.

WILDLIFE

The DEIS recognizes the importance of riparian areas to many wildlife species, including those dependent on the riparian area. The latter range from mink to ouzels to amphibians. The riparian area has the greatest diversity of wildlife due to its complex and diverse habitat. This diversity, however, is threatened partly by the effects of the fire and partly by the effects of salvage and/or harvest. The DEIS explicitly states the "stream buffer widths that are designed to protect water quality may not be adequate to fully meet the needs of all riparian species. The loss of foraging habitat and...riparian microclimate due to narrow buffer widths or reduced canopy closure will reduce the habitat necessary to maintain species diversity and self-sustaining population densities." (Chapter IV). Having explicitly stated the need for wide protective streamside buffers, the DEIS then proceeds to ignore this recommendation in setting out its riparian management guidelines (chapter II). If the biologists perceive the need for a wide no salvage/no harvest buffer, such guidelines should be implemented.

CUMULATIVE EFFECTS

In the DEIS for the PLRMP of the Willamette National Forest, both the Hills Creek and Middle Fork of the Willamette are rated as having "Probable" likelihood of cumulative effects (under the preferred alternative). Within the DEIS for this Project (under all alternatives), many of the rates of harvest, roading, and predicted sediment yields, peak discharges and stream temperatures are significantly greater than in the PLRMP. Given this increased potential for cumulative effects, there are two problems with the Project DEIS. Cumulative effects are assessed largely on the basis of ARP, which in some of the subbasins is projected be very low after salvage/harvest. ARP, although it is an excellent tool, should not be the sole parameter considered in cumulative effects predictions. For example, because ARP is considered over entire subbasins, it will not identify potential hazards in riparian areas from too much removal of LWD, stream cleanout, or other practices which can contribute significantly to downstream, cumulative effects.

Second, the DEIS infers that because Hills Creek flows into the reservoir, cumulative effects are not a concern. Hills Creek Reservoir, while it may not be a natural attribute of the watershed, does provide recreational opportunities, fish habitat, and strongly influences water quality downstream. Given the unstable and erosive soils in the Project area, extreme care should be used to minimize the potential for cumulative effects.

RECREATION

Although we did not carefully examine the economics or resource issues discussed in the DEIS, we did notice one curious statement in the Summary. Apparently, only timber resources were given a market value. We hope, that for purposes of economic assessment, parameters such as recreational resources, including boating, birding, camping, fishing or whatever, were also included. Granted, it is not as easy to put a dollar value on such non-commodity items. However, over the long-term, they may provide major economic benefits, especially locally. Such resources will be more easily damaged in view of the potential increases in sedimentation and other factors that result from both the fire and the subsequent management activities. We also hope that such values were projected beyond the 1989-90 values shown in Chapter II. This seems the epitome of overly short-term planning.

G009
PAGE 7 OF 10

SILVICULTURE IN RIPARIAN AREAS

Silvicultural practices in riparian areas are mentioned only briefly (Chapter II) in the DEIS. The overall riparian guidelines state that hardwood species, such as willow, will be planted along those Class II and III streams where high intensity burns removed all streamside vegetation. With all due respect for the rapid growth and shading abilities of willow, we hope the Project silviculturists are consulted first. If willow does not naturally occur on the site, we suggest planting other species, or at least placing the willow in discrete clumps. We have noted that willows can rapidly form streamside thickets that preclude regeneration of other species, including conifers. Other hardwood species, such as red alder or even big leaf maple, should also be considered, and silvicultural regeneration of riparian conifers should be implemented.

We also noticed that in all of the alternatives, varying amounts of acreage classed as unsuitable for reforestation are being proposed for salvage/harvest (in the preferred alternative, this constitutes 171 acres of land). We question the wisdom of such practices. If they are located on unstable, shallow-soiled, south-facing slopes, they will be particularly vulnerable to continual mass-wasting and hillslope failure, resulting in long-term deleterious sediment inputs to nearby streams. If these areas cannot be reforested, harvest/salvage essentially represents long-term degradation of forest resources.

MONITORING

At a recent meeting of biologists from Region 6 (Bend, OR; 3-7 April 1989), there were numerous expressions of concern over the lack of long-term monitoring on the Regional forests. The Shady Beach Fire Project appears to direct little effort towards monitoring either long- or short-term effects of both the fire and the subsequent salvage and harvest. We were pleased to see that the Project hydrologists placed monitoring stations at 13 sites within the Project boundaries, and assume these are continuous discharge recorders. We would also suggest that continuous temperature recorders be placed at the same monitoring stations. Such devices cost less than $700 each and would be an efficient and cost-effective way to monitor both stream temperature. Water quality, either temperature or suspended sediment, must be monitored on a basin level and not just in a few selected stream reaches. In particular, areas just downstream of both heavily burned and unaffected drainages would be the most important. Such a program would also provide a tool for detecting the potential of cumulative effects risks. The very brief section on monitoring (Chapter II) also does not mention the frequency with which water samples will be taken. Sampling during storms, particularly in the first years after the fire will be critical. Monitoring of fish populations can be undertaken using the methodology outlined in the section on fish.

At one point in the DEIS (Chapter II) the opportunity for future study of the burn area is mentioned. Much to our disappointment, this future study is limited to public education programs (which are extremely valuable) and monitoring of six plots, totaling 37 acres, that were in existence prior to the fire. No mention is made of the location of these plots and their relation to fire intensity and current conditions. It seems to us that the Project is missing a golden opportunity. Very little is known about the effects of fire on mature and old-growth systems, despite its clear importance as an ecosystem process. Many scientists, both at OSU and within the USFS-PNW Research Station, have long felt a need for this type of information. The Shady Beach area, with its combination of varying degrees of burn intensity and presence of forests in various stages of succession, presents a unique opportunity to study the impacts of fire and the nature of recovery. Unfortunately, such studies cannot be conducted on small plots (such as those already in existence), but need to integrate larger areas including hillslope, riparian and aquatic communities. Setting aside such areas for long-term follow-up could provide the USFS/WNF with a wealth of information on post-fire recovery processes, both in managed and unmanaged areas.

FOREST FRAGMENTATION AND LONG-TERM PLANNING

Forest fragmentation is probably the most critical long-term issue currently facing all national forests. As a result of past management practices, even if they were the best at the time, our forests have been diced up into small, isolated patches of varying conditions. In the Shady Beach DEIS, this issue received most attention from the wildlife biologists. However, during the discussion of the various alternatives (Chapter IV and Appendix G) fragmentation evidently received little attention. Appendix G lists numerous small (often less than 5 acres) harvest/salvage units, each with its own prescription. This type of management may lead to a chopped-up landscape lacking any sort of continuity.

The Project has attempted to provide some landscape cohesion by both subbasin planning and by using riparian areas as connections oar corridors among different patches. However, we are concerned that the narrowness of these corridors (less than 100 feet even along Class I streams) will preclude this function. We strongly urge that the 100 foot SMU be made a *minimum* no entry/no salvage/no harvest area along all perennial streams. In addition to increasing the potential for providing corridors for wildlife and plant distributions, such buffers would also provide better inputs of LWD and further protection from increases in stream sedimentation.

The planning and decision team needs to become familiar with both fragmentation issues and techniques used to minimize it, such as those currently being used on the Blue River Ranger District. The Project needs to look at the entire landscape of the fire, not just each unit or even subbasin, and to determine what it will look like over time. No such cohesive data are presented in the DEIS. We recommend that the GIS be used to generate descriptions of the landscape decade by decade for at least one rotation. The Project also needs to determine the desired future condition of this landscape. The combination of these two techniques should vastly improve the long-term management of this area.

SUMMARY

Our final recommendations concern the guidelines outlined for all alternatives (except B) in Chapter II of the DEIS. Although many of these ideas are innovative and well thought out, we are concerned with the following items:

(1) The no entry buffer width for Class I and II streams is too narrow. We recommend a minimum 100 foot no entry buffer from the edge of the active channel, with full protection of any existing floodplains. This will minimize sedimentation and temperature problems and will maximize LWD inputs.

(2) The no entry buffers for Class III are arbitrary and confusing. Because of their importance to downstream water quality, we recommend using the same guidelines as those suggested for Class I and II streams.

(3) The guidelines for Class IV streams may prove to be inadequate, especially in the many areas with unstable soils. We suggest a 50 foot no entry buffer be enforced along intermittent (water flowing 9 months) Class IV streams as well as those in areas of high mass-wasting potential. Stream channel clean-out should not occur, unless there is a danger of the material ponding up and later torrenting (an unusual set of circumstances). The other practices mentioned for sensitive Class IV's appear excellent.

(4) The suggestions for placing large woody debris in the channel (#6) are good as far as they go. However, we would suggest that placing debris every 300 feet may not be sufficient. Depending on the on-site conditions, LWD may need to be introduced much more frequently, and in accumulations. The fish habitat survey includes measures of LWD abundance, and would provide a basis for planning sites of LWD introduction.

(5) We strongly recommend the Project integrate the data, objectives, and management strategies over the entire basin, instead of looking solely at subbasins. This would allow more cohesive long-term planning and would provide a means to avoid further forest fragmentation.

G009
PAGE 10 OF 10

We would like to thank the Willamette Nation Forest and the Shady Beach Fire Project for allowing us to comment on this DEIS. We hope you find our comments and suggestions useful; we have certainly learned a great deal through our perusal of the documents. If your require further clarification or comments, please do not hesitate to contact us.

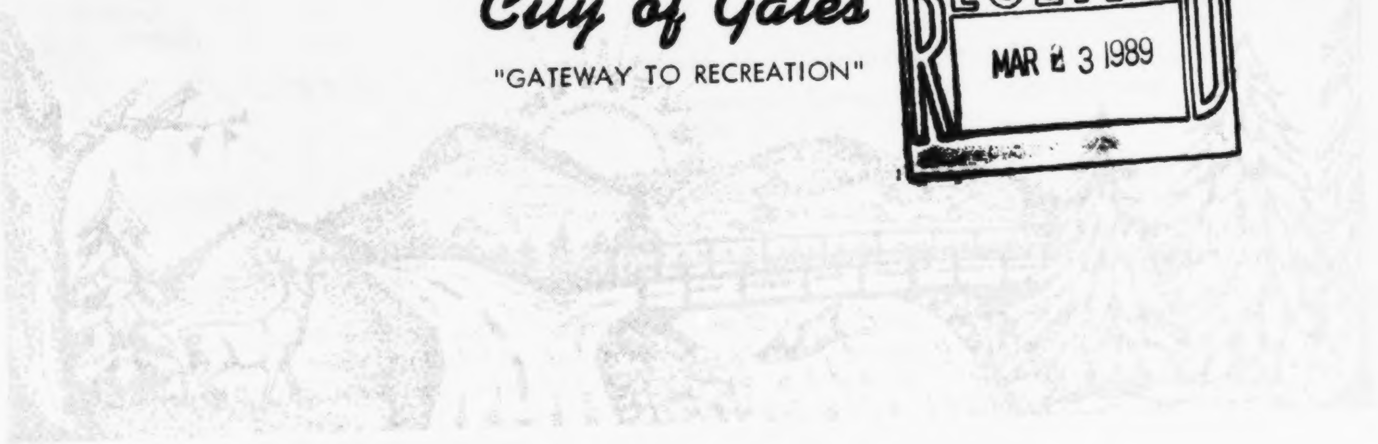
Sincerely,

Linda Ashkenas
Linda Ashkenas
Senior Research Assistant
Fisheries

Stan Gregory
Stan Gregory
Associate Professor
Fisheries and Wildlife

G001
Page 1 of 2

City of Gates
"GATEWAY TO RECREATION"



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MAR 23 1989

March 21, 1989

Shady Beach Fire Recovery Project
USDA Forest Service
48458 Highway 58
Oakridge, Or 97463

Recommendation of Alternative C

Please find enclosed a copy of a letter submitted to the City from Mr. Russell Goffin.

The opinions expressed in the first part of the letter are those of the Individual's and do not necessarily reflect the opinions of the City.

At the March 16, 1989 City Council Meeting, the Council voted unanimously to send Mr Goffin's letter and advise that the City does support his proposal that alternative C is the best alternative for this project.

Sincerely,

Ann L. Brown
Ann Brown/ City Recorder

(PD) 3/24/89

to [illegible] Comments

P.O. BOX 577 - 101 SORBIN ST. - GATES, OR 97346 - MARION COUNTY - PHONE: (503) 897-2669

G001
Page 2 of 2

Shady Beach Fire Recovery Project
USDA Forest Service
48458 Highway 58
Oakridge, OR 97463

I will call this letter "Devasting Times in Timber." The Spotted Owl controversy has already taken it's toll on hundreds of Mill Workers, loggers and their families. A coalition of environmentalist and preservationist who maintain the Spotted Owl depends mainly on old growth for their habitat, have caused enough litigation to begin the fall of Oregon's Timber Industry.

What's going to happen to the Mill Worker's, Loggers and their families who depend one hundred percent on Oregon's Timber Industry. Not to mention numerous jobs that are indirectly related that will be lost as well, if the groups are allowed to fullfil their plot against what is a huge part of Oregon's Economy.

The Timber Industry people are not just a figure or statistic to add to the already depressing unemployment figure. They have been and want to continue to be hard working, contributing and above all, tax paying members of their communities. They have kids in college, babies, elderly parents, house payments to support and they are the one's who are the endangered species.

These organizations obviously have provided themselves with a tidy little job and have no concern for the thousands of people of the Timber Industry. Furthermore, little or no concern for Oregon's Economy as a whole, and the scope of effects their "Save an Owl, Kill a Logger" plot will have. Let the Forest Service plan our Forest, and the attempts to advert them from that will stop wasting taxpayers dollars. I agree with Alternative C the most. All dead or damaged trees and associated green trees would be harvested. I understand that Alternative C has received the lowest percentage of comments. Studying all the scales and charts, Alternative C averages out the balance, whether it be erosion rate or board feet logged. Alternative C was also second in economic and social impacts.

Sincerely,

Russell Goffin

G002
page 1 of 1

Oregon's
DUNE
COUNTRY

Lower Umpqua Chamber of Commerce
P.O. Box 11 • Reedsport, Oregon 97467 • (503) 271-3495
Oregon Toll Free 1-800-247-2155

Reedsport, Winchester Bay, Scottsburg, Gardiner, Loon Lake

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APR 3 1989

March 31, 1989

Michael Kerrick, Forest Supervisor
Willamette National Forest
P.O. Box 10607
Eugene, OR 97440

Dear Mr. Kerrick,

You have a most unique position. In your hands and at your descretion are hundreds of jobs and thousands of dollars relevant to the Oregon economy. We have the ability to direct and renew the ONLY renewable resource in our county and the most important resource in OREGON, and you have the ability to take the issues into an arena that will make a difference for Oregon, the economy and future generations.

We are urging your support of the Alternative B for the Shady Beach Fire Recovery Project. This alternative makes sense for Oregon. It will provide a source of renewal for an area that has been devastated. We cannot afford to leave our land unproductive and in a state of cahos. With the current litagation regarding the acres of harvestable land our economy cannot withstand additional idle acres. This alternative prevents additional waste and will guarantee a forest for the future.

Thank you for this opportunity to share our concerns and we appreciate your consideration of the facts involved in this most critical issue.

Sincerely,

Christy Schafer

Christy L. Schafer
Secretary

G003

Sweet Home Chamber of Commerce

RECEIVED
APR 5

4-3-89

Michael Kerrick
Willamette National Forest
P.O. Box 10607
Eugene, Oregon

Dear Mr. Kerrick,

The Sweet Home Chamber of Commerce and its Board of Directors strongly supports Alternative B for the Shady Beach Fire Recovery Project.

Alternative B offers the best posible balance between timber salvage and envioronmetal concerns.

Of particular importance to our community of Sweet Home is the economic benefits to our county and school districts.

Sincerely,

Scott Proctor

Scott Proctor, President
Sweet Home Chamber of Commerce

Sweet Home
Oregon at it's best!

1575 Main St., Sweet Home, OR 97386 Phone (503) 367-6186

LIST OF COMMENTORS

This section is an alphabetical listing of names of the people who commented on the DEIS. The listing is organized by agencies, organizations, and individuals.

FEDERAL:

Public Health Service - Department of Health & Human Services
U.S. Department of Interior - Office of Environmental Project Review
U.S. Environmental Protection Agency

STATE OF OREGON:

Department of Environmental Quality
Department of Fish and Wildlife (NW)
Executive Department
Office of State Forester - Forestry Department

CITIES:

City of Gates - Ann Brown, City Recorder
Lower Umpqua Chamber of Commerce - Christy L. Schafer, Secretary
Sweet Home Chamber of Commerce - Scott Proctor, President

UNIVERSITIES:

Oregon State University - Department of Fisheries & Wildlife - Linda Ashkenas & Stan Gregory

ORGANIZATIONS:

Associated Oregon Loggers, Inc. - James E. McCauley
Audubon Society, Lane County - Arthur M. Farley
Bohemia Inc. - Keith M. Wright
Boise Cascade, Western Oregon Area - Kenneth P. Cummings
C & D Lumber Co. - Ricki N. Barnes
Cascade Family Flyfishers - Ed Holtgrave
McKenzie Flyfishers - Glen A. Love
National Wildlife Federation - Bruce Apple
Native Plant Society of Oregon - Rhoda M. Love & Mrs. Diane English
North West Timber Association - Ross Mickey
Northwest Forestry Association - Charles F. Shotts
Northwest Timber Workers Resource Council, Yakima, WA - Willis A. Cawley
Northwest Timber Workers Resource Council, Joseph, OR - Paul Morehead
Obsidians, Inc. - Emmy Dale & Dallas Cole
Oregon Hunter's Association, Emerald Valley Chapter - Lon Humphrey
Oregon Natural Resources Council, Western Regional Office - Wendell Wood
Rosboro Lumber Company - Gordon Culbertson
Sierra Club, Oregon Chapter - Bob Russell, Editor
Third Force for Forestry - Robert S. Winniford
Weyerhaeuser, Oregon Forest Products Division - James L. Rombach
Willamette Forestry Council - Mark Fleming
Willamette Industries, Inc, Western Timber & Logging - Jim James
Willamette Timbermen Association, Inc. - Foster Robinson
United Brotherhood of Carpenters & Joiners of America, Lumber & Sawmill Workers Local No. 2798 - John Roberts

LIST OF COMMENTORS

INDIVIDUALS:

Paul Aagaard
Ken Abbott
Phil Abbott
Ron Abbott
Ronald J. Abbott
Lee Abel
Constance Abell
Edward L. Abell
Elaine F. Abell
Robert S. Abell
John Able
Kathy Able
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R. Mark Adams
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Donald E. Adank
Wilbert Adank
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Ronald G. Adkins
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Elden R. Aerni
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Pete B. Aguilar
Michael Ahner
Kenneth Aiello
Nancy Aitken
Steven Akehurst
Janelle Akers
Bob Akins
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Jim L. Akins
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Steven C. Alberty
K. J. Albright
Mark Albright
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Donald Aldrich Sr.
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Deanna L. Armstrong
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Troy S. Backes
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Gladys Barstad
Melvin Barstad
Angela Barta
Marvin Bartel

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Eva Bartels
Bruce Barthuly
Bob Bartlett
E. R. Barton
Jimmy G. Barton
Larry Barton
Norman Barton
Ron Barton
Orlin W. Bartsch
Gale Barty
Clair M. Basey
Clarie Marie Basey
James S. Basey Sr.
Clair J. Bash
James L. Bash
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Ray Bess
Bonnie L. Bethel
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Albert N. Betz Jr.
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Ronald W. Bevier
Bill Beyer
Bruce Beyer
Clyde Bice
Leslie Bigbee
Bradeen Bill
Garrison Bill
Tucker Bill
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Dale Bilyeu
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Donald Binford
Kathy Bingham
Verle Bingman
Juliea Birkey
Lyle Birky
Thom A. Bishop
Roger Bissonnette
Fred A. Bitterman
Jerry Bitterman
Jim Bittleston
Loyce E. Bixler
Wayne Bjornerud
Frank E. Black
Ralph M. Black
Dave W. Blackburn
Dennis Blackford
William Blackwell
Bill Blain
Thomas S. Blair
Lewis D. Blais
David P. Blake
Michael R. Blake
Gary W. Blanchard
Michael Blanchard
James Blankenship
Mike Blankenship
Gary Blanks
Robert Blanshan
Jeff Blaser
Ray S. Blaser
Vaughn Blasingame
James C. Blatchey
Dwight Blatchley
Clint R. Bledsoe
Larry Blem
Loda B. Blevins
Bruce L. Blew
Everett Blilie
Leanna Bliss
Steve Bliss
John Blodgett
Philip Blomquist
Carl Bloomfeldt
Larry L. Blosch
John Z. Blower
Lee A. Blue
Lewis F. Bly
Christopher Blythe
Greg Boatright
Marion Boatwrighty
Curtis Bodenstab
Darrel Boedigheimer
Gus H. Boen
Dean R. Boer
Hans Boer
Rhonda Boer
Robert J. Bogan
Edward S. Boggie
Gerald D. Boggie
Bruce Boggio
Michael L. Boggs
Harold Bohn
Nancy Bohn
Richard L. Bohn
Sheryl Bohn
Wayne G. Bohrer
William Bolding
Larry Bolen
Kirmit L. Boles
Max G. Boles
Daniel P. Bolis
Michael G. Bollen
Brian Bolman
Russell L. Bolman
Mark F. Bolte
James Bond
Laramie Bond
Monty R. Bond
Philip Bonde
Renell E. Bondo
Gregory Bonnichsen
Calvin Bons
Wendell D. Boodry
David Book
C. W. Booth
Ronald J. Boots
Sherri Boots
Gordon Borchgrevink
James R. Borders
Jess G. Borders
Lester A. Bordges
Albert R. Borges
Tom Borland
Michael Bormuth
Hank W. Bos
Glenn Bosshardt
Cliff Bosteter
Jim L. Bottoms
Jack Bottoref
Raymond Bottorff
Cassandra R. Botts
Roy A. Bounds
Rick L. Bowd
Gary Bower
Susan A. Bower
Sally Bowers
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Edmund F. Bowles
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Larry E. Bowman
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Jeffrey Boyle
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Leiisa Boytz
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Donna M. Bradley
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Gary Brady
John R. Brady
Mary L. Brady
Michael Brady
Royce Brady
Phyllis Brainard
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Gary A. Branch
Terry L. Brand
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Brice L. Brandt
Robert H. Brandt
Thomas Brandt
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Wade T. Branscum
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Monte J. Branson
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Damun A. Braunger
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Herman Brawner
Bobbie Breedlove
Jeff Brennan
Stan Brennan
Scott Brenneman
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Ronald M. Brewster
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Michael C. Briggs
Sandra J. Briggs
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Anne Brinkley
LeRoy Brinkley
Tom H. Brinkley
Albert Brint
Larry Brissette
Kenneth Bristow

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Wallace Brock
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Ken R. Broeke
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Gary S. Brothers
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Della Brown
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Dennis L. Brown
Dennis W. Brown
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Lois Bryant
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Sharon A. Bunnell
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Noble Burgess
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Karl Burgmeier
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Merlin Burnett
Andy Burnette
Kevin Burnette
Donald Burnham
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James Burns
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Sue Burns
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Michael Burrill
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Beth Campbell
Charses C. Campbell
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Everett L. Campbell
Katherine Campbell
Leroy H. Campbell
Lila Campbell
Oeuf Campbell
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Larry Carter
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Sheridan Carter
Steve Carter
Todd Carter
Vernon D. Carter
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Burl C. Cash
Jim Cash
Franklin Casner
Jim Castle
Larry Casto
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Malcolm Cazimero
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Perry Christensen
Jay Christiansen
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Charline Christopherson
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Bryan D. Clark
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Elmer J. Clark
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Jerry L. Clark
Jon Clark
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Stanley Cox
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Lloyd Crafton
Wayne Crafts
Harold Craig
James C. Craig
Ron K. Craig
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B. Wanda Cramer
Tim Crammer
Richard Crandall
Fred J. Cranmer
Samuel Craven
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Buster R. Crawford
Claude H. Crawford
Gloria Crawford
H. W. Crawford
Jack Crawford
Keith Crawford
Kimberly Crawford
Larry W. Crawford
Mark Crawford
Roger Crawford
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Ronald Crawford Jr.
Phillip Crawford Sr.
Donald Cree

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R. C. Crenshaw
Marion Crisp
Phil Crisp
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Bev Crocker
Diane L. Crocker
Joe Crocker
Kay Crocker
Perry Crocker
Donald Crockett
Virgil K. Cromer
Brand Cromwell
Kenneth Cromwell
Dennis L. Cronen
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Stewart Cross
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Mary H. Crowell
Robert V. Crowell
Robert W. Crowell
Bill A. Crowl
Caroline Crowson
Gilbert Crowson
Jim Crowther
Richard G. Crueger
Charles H. Crump
Charles D. Crumpton
John F. Crutchfield
Margaret Crutchfield
Gordon Culbertson
Lane L. Culbertson
Richard Culbertson
Tom Culhane
Guy M. Cullen
Greg Cullhane
Gaylen Cullum
Dudley Culpepper
Jerald E. Culver
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Clyde A. Cummings
Diane S. Cummings
Gary L. Cummings
Kennith P. Cummings
Lyle Cummings
Tina B. Cummings
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Lyle P. Cunningham
Mildred Cunningham
Duane A. Cunnington
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Patsy Currey
Robert Currey
Ronald R. Currey
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Louise Curtis
Michael W. Curtis
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Vance Curtis
Walter E. Curtis
Thomas F. Curtright
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Thomas Cutsforth II
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Harold Dahle
William Dahmen
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Joe E. Dalla-Bona
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Dawn Dalton
Douglas R. Dalton
Gorgia Dalton
Kerry Dalton
Peggy L. Dalton
Ronald W. Dalton
Douglas Damerval
Charles Dammarell
Francis C. Damon
Terry Damon
James L. Daniel
Jeff Daniels
Linda L. Daniels
Paul B. Daniels
Richard Daniels
Stan R. Daniels
Mike Danielson
Rodney Danielson
Gary Danner
Gary A. Danner
Melvin E. Darby
Donald Dargis
Maxine Dargis
Cecil F. Darling
Donald M. Darling
Thomas W. Darling
Robert C. Darling Jr.
Edward Dart
Robert Datz
Delores Dausel
Doris A. Davenport
Linn Davenport
Rick L. Davenport
Robert Davenport
Alfred Davenport Sr.
Chris Davidson
David J. Davidson
Gordon Davidson
Jerald Davidson
John E. Davidson
Mark A. Davidson
Myrtle Davidson
Roy E. Davidson
Shirley Davidson
Tricia Davidson

LIST OF COMMENTORS

Donna Davies
J. A. Davies
Bobby Davis
Dan D. Davis
Dennis R. Davis
Eldon R. Davis
George A. Davis
Jean Davis
Jeff Davis
John W. Davis
Juanita Davis
Kelly M. Davis
Larry Davis
Linda J. Davis
Lonnie Davis
Lora Davis
Marion R. Davis
Myrtle Davis
Nancy C. Davis
Patricia Davis
Robert R. Davis
Ronald C. Davis
Ted R. Davis
William A. Davis
William E. Davis
Katherine Davison
Harry Dawson
James Dawson
Frank Days
Dennis R. Dayton
Frank De Rosso
Karen L. DeBord
John DeBrie
Donald DeForrest
Judy DeForrest
Daniel R. DeGroat
Cheryl DeHart
Duane K. DeHart
John H. DeLoach
Mary DeLong
Debra R. DeLosa
Tony DeLosa
Marium DeMeyer
Marius M. DeMeyer
Scott M. DePriest
Alvin DeSpain Jr.
Ken DeVaney
Dorothy H. DeVeau
Dante W. DeWald
Allen R. Dean
Della L. Dean
Douglas Dean
Larry P. Dean
Burce Deardorff
Gale Deardorff
Ardis Debban
Ivan A. Debbn
Peter A. Debusk
Gordon C. Decker
Edna Declasin
Lloyd Declusin
Dennis Deere
Leonard Deffensaug
Jeffrey Dehne
Dale Delaney
Michael Delworth
Karl Demmrest
Vernon Demorest
Alice Denham
Ralph H. Denham
William Denham
Derald Denkins
Everett Denner
Joseph C. Denney
Arnold L. Dennis
Beverly A. Dennis
Ernest A. Dennis
Hillis K. Dennis
Larry W. Dennis
Nola M. Dennis
Bob Denny
Gerald Denton Jr.
Mark G. Derby
Tom Derbyshire
Melvin Derrick
Peggy A. Derrick
Rita Derrick
Harold Derry
Guy W. Dery
Kim Desadier
Geri Deskins
Floyd Dewald
Gary Dewar
Rolyn Dey
Joe D. Deyo
Dale Dial Jr.
Jeremy Dice
Rickey L. Dice
Beverly Dick
Brenda Dick
Douglas Dick
Larry Dick
Richard Dickens
Dorothy Dickerson
Harold Dickerson
Debbie Dickinson
Mary A. Dickinson
Mary Ann Dickinson
Rick Dickinson
Robert Dickinson
Charles Dickstein
Leon D. Dies
Frank Dietrich
Steven Dietrich
Carolyn Dillman
Gene A. Dillon
James Dillon
Steve Dillon
Chauncey Dimick
Stephen Dimmell
Patricia Dimmick
Grace M. Dinon
Lyle J. Dirksen
Rosemary Dirksen
Michael Ditlefsen
Walter Dix
Clarence Dixon
Duane A. Dixon
Grace M. Dixon
Warren Dixon
Alton Doan
Debra Dobkins
Floyd Dobkins
Denise Dobrinin
Kelly Dobrinin
Andy Dobriwiw
Kathleen Dodge
Larry W. Dodge
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Terry Dodson
Thomas Dodson
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Larry Doggemeyer
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Cheri Doll
Sharyl K. Doll
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Danny E. Donica
Rockey Donica
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Timothy L. Donivan
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Dale Dorris
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Raymon L. Doty
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Lawrence J. Doud
Willard Doud
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Scott A. Downey
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Ronald E. Dragoo
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Thor C. Edvalson
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Chester Edwards
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R. Loren Emmertt
Ida R. Emmons
Kirk End

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Stephen Erb
Les Ereth
Delaine Erickson
Iran Erickson
Leatriee Eriekson
Evan K. Eringer
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Rayburn Erwin
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Hector Esparza
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Harold Evernden
Steven Evernden
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Ray Everts
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Earl Fitzgerald
Kelly Fitzgerald
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Dorma Horner
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Kerry Hosler Sr.
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Curtis House
Janice House
William Houseman

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Steve P. Howard
Thomas Howard
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Jerry Hudson
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Craig Huffman
Harold Huffman
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King Hufford
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Roy Huges
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Christopher Hunt
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John L. Hunt
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Gerald D. Hunter
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Lesli L. Hunter
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Melyssia Hunter
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Glade A. Jackson
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James E. Jackson
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Lon Jackson
Loyd G. Jackson
Lynn L. Jackson
Michelle Jackson
Robert Jackson
Rodney Jackson
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Roy Jackson
Sue Jackson
Thomas Jackson
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Decker Johnson
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Michael Koubele
Danial Kowitz
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John F. Kraemer
Jeff Kraguess
Gary Krambeal
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Ronald G. Krebs
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Pamela Kronberger
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Gregory Krpalek
Marlys Krueger
Steven R. Kruesi
Kathyrn Kruk
Misty H. Kruk
Myrna Kruk
Romeo H. Kruk
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John F. Kujava
Theodore E. Kukek
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Ronald Kummer
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C. Kay Kunzman
John K. Kunzman
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Gerald A. Kutch
Ivo Kuzela
Leo Kwapp
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Steve Lake
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Richard Lambert
Gary Lamin
Alan Landerholm
Boyd R. Landrum
Harvey Landtroop
Albert Lane
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Robert Lane
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Delbert Langdon
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Gary Morgan
Helen L. Morgan
John Morgan
Les Morgan
Pam Morgan
William Morgan
Mark Morgans
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Don Morrell
Don K. Morrell
Donna Morrell
Scott Morrell
Bob Morris
Dennis Morris
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Ivnn F. Morris
Lois Morris
Martha Morris
Tammy E. Morris
Timothy M. Morris

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Carl G. Morrison
David Morrison
Marven Morrison
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Michael Morrissey
William D. Morss
Paul Mortenson
Paul Mortenson
Virgil Morton Sr.
Walter K. Moseley
Larry Moser
David Moskowitz
Ben Moss
Harold N. Moss
Rodney Moss
Travis J. Moss
Wayne Moss
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Oliver F. Muise
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Ray Murphy
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Toni Murray
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Michael Murtrugh
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Freda L. Musgrove
Robert R. Music

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Jaunita My
Samuel D. Myer
Sam Myers
Craig B. Myrmo
George Myrmo
Cash K. Naftzger
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Daniel J. Nase
Delbert R. Nash
Randall S. Nash
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Sidney A. Newton
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Chu Sun Nicholson
Scott Nicholson
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Scott K. Nicholson
W. A. Nicholson
Eric L Nickell

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Dennis Nickerson
Randy Nicklous
Bernand Niclsen
Walter F. Niclsen
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Loretta Nielsen
Neil Nielsen
Henry Nielson
Doris L. Nieman
William B. Nieman
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Dale Nier
Jean A. Nier
Joanne Nieuwstraten
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Mark W. Noah
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Marvin Norton
Ronald Norton
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James Poindexter
James Pointer Sr.
Kenneth E. Polk
Lavelle Polk
James C. Pollard
Paul A. Pollard
Stephen Pollock
Charles Pope
Sam Pope
Colman Porter
Gravit Porter
Katherine Porter
Keith Porter
Richard Porter
Ronald D. Porter
Tim C. Porter
Wayland Porter
Tammy R. Porth
Dick Posekany
Julia Posekany
Phyllis Posekany
Rick Posekany
O. G. Post
Ken Postma
Ben Potter
Debra Potter
Eathlyn Potter
Gordon Potter
Leon Potter
Mark Potter
Oscar Potter
Rex E. Potter
Rollo Potter
Terry B. Potter
William R. Potter
Lori K. Potterf
Steve Potwin
Billy Powell
Clyde Powell
David Powell
Emery Powell
Holly Powell
Janice Powell
John C. Powell
Kenneth Powell
Lisa Powell
Noble Powell
Scott Powell
Wayne Powell
Jerry Pratt
Marie Pratt
Michael Pratt
Kimla Preedy
Edward Premo Jr.
Alfred L. Preno
Charles Prentice
Earl W. Presley
Ernest E. Presley
Harold D. Presley
Gordon Price
Jeff Price
Robert L. Price
Ronald O. Price
Timothe L. Price
Michael Prichard
Patrick Pridgen
Brian Priest
Mary A. Primasing
Tim Primasing
Ray Prindel
Theodore Prindel
Dennis Prociw
Roger D. Proctor
S. K. Fox Proctor
Robert Prosch
Earl W. Proudfit
Allen E. Prouty
Art Prouty
Dennis G. Pruett
Howard Pruett
John Pruett
Clarence Pruitt
James Pruner
Oliver Prutt
Frank A. Puckett
James N. Pugh
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Tom Pullen
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Glen A. Putnam
William Putnam
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Duane Putney
Lori L. Putney
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Marvin Quaschnick
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George W. Quick
Kenneth D. Quick
A. J. Quinn
Ray Quinn
Bob Quinnory
Walter Quiring
Wilbur J. Quiring
Betty L. Raaf
Raymond R. Raaf
Bud H. Racy
Joanne Ragan
Robert Ragon
Francisco Raigosa
David R. Raines
Gerald L. Raines
Anna Rainey
Elmer Ralls
Laudie Rambousek
Enrique Ramirez
Jesus Ramirez
Marquita Rampenthal
William Rampenthal
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Eugene Randall
Mike Randall
Bill Randolph
Earl M. Randolph
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Harlan Ransdell
Fred Rarie
Timothy Raschko
Dan Rash
Erik W. Rasmussen
Lynelle Rasmussen
Richard Rasmussen
Ron Rasmussen
Donald Rasor
Jeni K. Rasor
Philip E. Rasor
Wanda Rasor
Stuart Raspone
Darlene Ratliff
Donald Ratliff
William Rauch
Mark Raumgartner
Irene Rawn
Antonette Ray
Bruce Ray
Cheryl L. Ray
Dirk Ray
Jack L. Ray
Kenneth L. Ray
Louise Ray

LIST OF COMMENTORS

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William Reager Jr.
William G. Reaney
Donald Reasoner
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Clifford Reddig
Gil Reddington
Wesley Redmond
Burton Reed
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Jacob L. Reed
Keith T. Reed
Mary Reed
Michael Reed
Rhonda Reed
Ronald Reed
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Evalyn Reeves
Frank Reeves
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George R. Reid
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Patricia A. Reid
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Gary Reimer
A. Troy Reinhart
A. T. Reinhart
Arnold D. Reinhart
Ty Reinhart
Robert Reinking
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Liz Rekow
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Victor H. Rendler
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Blair Reynolds
Charlie Reynolds
Jean Reynolds
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Sue M. Reynolds
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John T. Rhodes
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James R. Rice
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Scott Rice
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Frank Richards
Steve Richards
William Richards
Jason Richardson
Shawn Richardson
Carl Richardson II
Dorman G. Richert
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Dean Ricks
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Wanda Ridinger
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Wayne Rieskamp
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Geraldine Riggs
Judith A. Riggs
Lloyd Riggs
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Ronald M. Riggs
Steven L. Riggs
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Margaret Ringheimer
Randy Ringheimer
Walter Ringhelmer
Todd W. Ringler
Ronald Ringler Sr.
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Roxy S. Rios
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Michael Ritter
Paul J. Ritter
Jolyn Ritzschke
Byron Ritzsehki
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Earl Rivers
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Douglas Roberts
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Foster Robinson
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Sue Robinson
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Todd Rogers
Walt Rogers
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Earl E. Rohlf
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Melvin Rohrich
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Larry Roofener
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Harves Roush
Jerry Roush
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Charles Scecina
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Roberta Schram
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L. P. Schreiber
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Dennis Schrick
Raymond Schrock
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Lynn Schroeder
Randall Schroeder
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Sandra Schroeder
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Russell Seiber
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Ella Sele
James L. Sele
Stuart Seleen
Damon Self
Mildred Sells
Rodney Sells
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Tammy Settle
Freddy Setzer
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Gregg Severns
Michael Severns
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Violet Seyler
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Norwood Shoemaker
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P. K. Shriver
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Larry Shrum
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Terry Shulmire
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Donald Sickles
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Nolan Sieg
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Leona Sigfridson
Lewis Sigman
Thavisak Siharath
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Glen R. Silvers
Mabel S. Silvers
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Joni Simmons
Lavonne Simmons
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Debbie Simonis
Michael Simons
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Heather Simpson
Rick L. Simpson
Steven Simpson
Martha Simpson Pardo
Gerald D. Sims
Larry Simshauser
Roland Simshauser
Albert Sinclair
Scott Singler
Mickey Singleton
Pat Singleton
James Sink
Dale Sisco
Theresa Sisco
Tom Sisco
James Sisenby
Jerry Skaife
Timothy Skeels
Dorothy Skelton
R. K. Skiller
Harold Skinner
Jack Skordahl
Joe Skordahl
Glen Slack
Earl Slade
Bonnie Slagle
Brian Slate
Harold Slater
Lenora Slatter
Kinnon Slaughter
Sam Slaughter
Arnold Slaven
Mark Slezak
Dorothy Slinger
Edward Slinger
Scott A. Slinker
Donald D. Sloan
Ilene Sloan
John A. Sloan
Robert J. Sloan
Robert W. Sloan
William D. Sloan
Thomas Slyter
Ellen N. Small
Mark F. Smalley
Keith Smart
Myrtle Smigley
Albert Smith
Alnice Smith
Betty J. Smith
Bret Smith
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Charles P. Smith
Charles W. Smith
Craig A. Smith
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Danny Smith
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Dennis L. Smith
Donna Smith
Edgar Smith
Edward A. Smith
Ella Mae Smith
Floyd A. Smith
Floyd S. Smith
Frank Smith
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Freddie C. Smith
Frederic E. Smith
G. L. Smith
Gary C. Smith
Gary L. Smith
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Gerald Smith
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Gregory E. Smith
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Jerry Smith
John W. Smith
Jon L. Smith
Kenneth N. Smith
Kenneth R. Smith
Kent M. Smith
Kirkly B. Smith
Laura Smith
Lela M. Smith
Leon W. Smith
Leonard Smith
Lyle V. Smith
Mark A. Smith
Mary H. Smith
Mary L. Smith
Michael E. Smith
Philip L. Smith
R. L. Smith
Ralph Smith
Randall G. Smith
Raymond Smith
Raymond F. Smith
Robert A. Smith
Robert W. Smith
Ron Smith
Russell L. Smith
Sandra J. Smith
Scott Smith
Selma J. Smith
Sharon A. Smith

LIST OF COMMENTORS

Sharon R. Smith
Steven J. Smith
Sylvia Smith
Terrence G. Smith
Terrence L. Smith
Thomas A. Smith
Tim Smith
Troy Smith
Vickie Smith
Waldo H. Smith
Wesley Smith
William R. Smith
William T. Smith
Gary W. Smith Jr.
Richard Smith Jr.
Robert Smith Jr.
Merrill A. Smutz
Barbara Snell
Donald G. Snell
Dean Snook
Henry Snow
Kenneth Snowberger
John F. Sohlman
Gary S. Solberg
Robert Solders
Forrest Solomon
Jerald Solomon
Daniel Sommers
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Sharon Sommers
William Sommers
W. L. Sommers Jr.
James K. Sonisto
S. A. Soonthorn Noy
Noma A. Soper
James Sorrell
Ron Sorrell
Craig Sorseth
Bob Southwell
Eric Southwick
Amy Sowa
Fred Sowa
James Sowell Jr.
Allen Sparhawk
Kenneth Sparhawk
Susan Sparkman
Jerry Sparks
Roger E. Sparks
Mary M. Spear
Ralph N. Spear
Dennis Speck
Linda M. Speece
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Donald C. Spencer
Errol Spencer
Greg E. Spencer
Verdine Spencer
C. D. Spencer Jr.
Rickey Spencer Jr.
W. David Sphuler
J. L. Spicer
Dale R. Spier
Mike D. Spier
Anne L. Spies
David A. Spies
William C. Spies
Denton A. Splide
Gregory Spradlin
Ruth Spradlin
William Spradlin
Richard Sprague
M. D. Sprauge
George Spriggs
Charlette Springer
Donna Springer
John Springer
Margie Springer
Randy Springer
Richard Springer
William Springstead
Damian Sprinkel
Fred Spurgeon
W. K. Spurill
Faye Squire
Harold Squire
Pauline Squires
Dennis St.Clair
Sam St.Clair
Carolyn St.Hilaire
Donald Stacey
Peggy L. Stacey
Richard Stacklan
Jonathan Stadden
Billie Staggs Jr.
Floyd L. Staley
Jim E. Standard
Wayne Standeford
Steven Stanford
Ronald Stanley
Mark J. Stanton
William L. Stark
Vicki L. Starner
Dan Starnes
William Starnes
Donald Stathos
David Stauffer
Michael Stauffer
Ed Stayffer
Richard Steatton
Lester Steckly
Sherry Steckly
Richard Stedman
Gary Steele
Marlon P. Steele
Mike Steen
Rosemary Steenson
W. F. Steers
Daniel Stein
Jack H. Stein
Robert Steinbacker
Bobby Steinhoff
Stanley Steinhoff
Darren Steinlicht
Dale R. Stennett
Donald Stephens
Joe Stephens
John Stephens
Rich Stephens
Charles Stepp
Gary D. Stepp
David Stern
Debrah Stern
Alberta Stevens
Carol A. Stevens
Charles Stevens
Craig Stevens
Diane M. Stevens
Gerald J. Stevens
Jerry Stevens
Mark E. Stevenson
Michael Stevenson
Stanley Stevenson
Timothy Stevenson
C. T. Stewart
Carrol Stewart
Eugene Stewart
James K. Stewart
Kelli S. Stewart
L. L. Stewart
L. M. Stewart
Lester Stewart
Richard Stewart
Sandra Stewart
Steve Stewart
Steven Stewart
Tory Stewart
Inez L. Stice
Orville Stiff
Dennis Stinson
Douglas Stinson
Jayne Stinson
William Stinson
Frances K. Stock
James E. Stock
Randy Stock
Charles R. Stocke
Dennis R. Stocker
Robert Stockton
Vernon Stoddard Sr.
Stanley Stolp
Stanley Stoneberg
Steven Stonebreaker
Patricia Stoneking
Jay R. Stoner
Richard G. Stoney
Edwin Storbeck Jr.
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Judith Storey
Steve Stormont
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Ron Story
Terry E. Story
Douglas E. Stout
Kathy L. Stout
Richard Stoutenburgh
Kevin Stowe
Ricky D Stralton
Otis K. Strang
Bart Strawn
Ronald Stream
Dorothy Strean
James Strean
Barbara Stredwick
Chane Strickland
Larry Strickland
Shawn Strickland
Rick Stringfield
Karen E. Stroda
Kathy Stroda
William Stroda
David Strong
Jim Stroud
Susanne Stroud
Allen Struthers
Kirk Studach
Philip Stude
Elic Stufford
Adam W. Stuhr
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Wendy Stuner
Okey Sturgell
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Roy Sturtenant
Colette Sturtevant
Dan Sturtevant
Jerry A. Stute
Joe E. Stutzman
Shane Stveve
Tim Sudbrock
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Tom Sudway
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Ronald W. Suller
Bruce Sullivan
Darwin Sullivan
Earl Sullivan
John L. Sullivan
Billy D. Summer
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LeRoy Surcanp
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Lonnie Sutton
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Matt Swain
Lloyd Swander
Donna Swank
Vern Swank
Chris Swanner
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Jennifer Swearingen
Jerry Swearingen
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Gerald Syphers
Bendy Tacy
Bill Tacy
Lee Talbott
Darvin Tanzey
Sandra Tanzey
Rocky Tappan
Lyle Taresh
Virgil Taresh
L. B. Tart
Bob Tate
Sharon Tate
Gerrhal Tatro
Bob Tatum
John L. Tatum
Frank Taubenkrau
Shirley Taubenkrau
Dale Taxdel
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Bret Aaron Taylor
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Chris Taylor
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Sandra Teilmann
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Brian Templeton
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Oleta Tenbusch
Richard Tenbusch
Ken Tendick
Lucille Tendick
James Tengstler
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Linda Terhune
Jerry Terletter
Linda Terletter
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Perry Thiede
Richard Thiel

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Dennis Thompson
Francis Thompson
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Randel Thornton
Randy Thornton
Ronna Thornton
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Robert L. Tolman
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Charles Tompkins
Marty Tompkins
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Stephen Tracer
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Buckner Treuillian
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Stephen Truesdell
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Mike Trumbull
Nancy Trumbull
Ryan Trumbull
Willard Trumbull
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Rosalie Turnbull
Tashia Turnbull
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Albert Vann Epps
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Ronald G. Vining
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Ronald S. Vinson
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Bruce Vollstedt
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John R. Warren
Richard Warren
Ronn Warren
Rosa Warth
Siegfried Warth
Patric H. Washa
Stan Washington
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Donald Wasteney

LIST OF COMMENTORS

Jerol Wate
Nancy Waters
Richard Watkins
Russ H. Watkins
Howard Watne
Douglas Watson
Jacquelyn Watson
Joe W. Watson
Kenneth Watson
Leonard Watson
R. P. Watson
Ted H. Watson
Ronald Watts
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Jerry R. Waxbom
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James V. Weathers
Leon D. Weathers
Lonita Weathers
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Jeanette Welty
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Leonard Willyard
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Steven R. Wooley
Glenn Woolhiser
Ruth Woolhiser
Carey Woolsey
Bartley Workinger
Danny Worth
Bob Worthington
Naomi Wostli
Lowell Wourms

LIST OF COMMENTORS

Lyman Wray
Lyle W. Wren
Edward V. Wright
Estel G. Wright
Glennys B. Wright
Harry Wright
Herbert A. Wright
Katherine Wright
Keith E. Wright
Mike L. Wright
Steven L. Wright
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Bradley Wyscarer
Elden Wyscaver
Calvin Wytcherley
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Beth Yates
Kenneth A. Yates
Gary W. Yeager
Norma B. Yeomans
Gary R. Yoast
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Timothy York
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Floyd M. Yost
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Cheryl Young
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Wanda E. Zettle
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Kenneth Zimmerman
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Delwyn Zollman
Cynthia D. Zosel
Bruce Zuber
Jean L. Zuber
Connie Zurcher
Marlene Zurcher
Marvin Zurcher
Ronald Zwart
Robert Zysett

LIST OF PREPARERS

Name: Area of Expertise	**Education**	**Experience**
Cathy Barbouletos: Project Leader (1/17/89 to 6/12/89)	MS-Forest Mgmt/Hydrology	11 years
James E. Williams: Project Leader (9/25/88 to 1/16/89)	BS-Forest Management	18 years

INTERDISCIPLINARY TEAM

Dave Maercklein: ID Team Leader	BS-Forestry	09 years
Rick Ley: Interim ID Team Leader	BS-Forest Management	13 years
Dick Connelly: Logging Systems/Transportation Leader	High School Diploma	31 years
Roddy K. Baumann: Fire, Fuels & Air Quality	BS-Forest Management	21 years
Frank Carson: Recreation Planner	BS-Range Management	18 years
Josiah H. Cornell, III: Geologist	MS-Geology	17 years
Karen Engelhardt: Landscape Architect	BLA-Landscape Architect	06 years
Fred L. Henley: Landscape Architect	BS-Landscape Design	25 years
Anne E. Huebner: Economist	PhD-Nat.Res. Economics	03 years
G. Dennis Kelly: Hydrologist	MS-Forest Hydrology	22 years
Ken Kestner: Wildlife Biologist	BS-Biology	10 years
David Murdough: Soil Scientist	BS-Soil Science	13 years
Paul W. Survis: Silviculturist	BS-Forest Management	12 years
A. William Zukosky, Jr.: Archeologist	MA-Anthropology	09 years

Bob Russell: Sierra Club
Bob Lindsey: Willamette Timbermen Association
Burt Cleary: Oregon Department of Fish and Wildlife
Mark Wade: Oregon Department of Fish and Wildlife

ID TEAM SUPPORT PERSONNEL

John Bascom: Logging Systems/Implementation	AS-Forest Technology	20 years
Jill A. Beatty: Silviculture	AS-Forest Technology	02 years
Les Buystedt: Civil Engineering	High School Diploma	12 years
Debra Couche: Soil Science	BS-Range Management	11 years
Bob Chuey: Silviculture	BA-Psychology	07 years
Ron Dean: Silviculture	AS-Forest Technology	08 years
Tom Jackson: Logging Systems/Transportation	BS-Forestry	12 years
Green B. Kent: Transportation Planning	Reg. Civil Engineer	36 years
Gordon Kitching: Transportation Planning	AS-Survey	29 years
Mark J. LaPine: Silviculture/GIS/Implementation	BS-Forest Management	11 years
Mike Malone: Logging Systems Planning	AS-Forest Technology	12 years
Leon Mork: Logging Systems/Transportation	BS-Forest Management	15 years
Richard Toupin: Logging Systems Planning	MS-Forestry	12 years
Warren H. Pavlat: Ecology & Sensitive Plant Coordinator	BS-Range Management	28 years
Robert J. Zwirtz: Mortality Assessment	MS-Forestry	25 years

CUMULATIVE EFFECTS

Richard A. Kennedy, PE: CE Team Leader	BS-Civil Engineering	11 years
Erick A. Bestland: Geology/Soils/Hydrology	MS-Geology	01 year
Don Boyer: Soil Scientist	BS-Agronomy	30 years
Al Johnson: Hydrology/Writer/Editor	BS-Forest Management	10 years
Robert W. Rock: Hydrologist	BS-Forest Management	12 years
Kent Smith: Hydrologist	BS-Hydrology	13 years
Berntina T. Steele: Wildlife Biologist	BS-Wildlife/Range Res.	10 years
Walter Perry Wilson: Hydrology	BS-Biology	09 years

RESOURCE INFORMATION MANAGEMENT (GEOGRAPHIC INFORMATION SYSTEM)

Terri L. Jones: Resource Information Manager	BS-Forest Management	08 years
John R. Steffenson: GIS Coordinator/Resource Information Manager	BS-Geography	10 years
Tony Bacon: Programmer/Analyst	Diploma-Data Processing	03 years
Dean Devlin: MOSS Operator	High School Diploma	05 years
Peter Eberhardt: Cartographer	BS-Geography	06 years
Margi Elliott: Database Manager	High School Diploma	11 years
Thomas J. Graves: Systems Manager	Diploma-Business College	27 years
John Hawkins: LIDES Leader/Database Specialist	BS-Forestry	12 years
Laura Hoffman: LIDES Leader/Editor/Operator	BS-Resource Mgmt.	01 year
Nora Holmquist: Database/MOSS Leader	BA-Mathematics	09 years
Paul V. Howard: MOSS Operator/Cartographer	BS-Environ. Geography	07 years
Janeta Huckeby: MOSS Operator	High School Diploma	10 years
Karen A. Meza: LIDES Editor/Operator	Certificate-Accounting	11 years
Debra L. Murdough: Database Specialist	High School Diploma	09 years
Rick D. Murphy: Database Specialist	BS-Forest Management	03 years
Howard Parker: Computer Systems Management	MS-Computer Science	15 years
Stephanie Schulz: LIDES Editor/Operator	BLA-Landscape Architect	03 years
Diana Walker: MOSS Operator	AS-Forest Technology	10 years
Rita Wilson: LIDES Editor/Operator	High School Diploma	01 year

DOCUMENTATION

Erin Ely: Document Group Leader	BS-Biology/Forest Mgmt.	08 years
Tim Bailey: Writer/Editor	BS-Forestry	10 years
Charlotte Blumenthal: Writer/Editor/Layout	AA-Journalism	07 years
Joseph C. Carbone: Writer/Editor	MS-Forestry	10 years
Dale F. Kane: Analysis File/Sale Appraiser	AA-Parks Management	13 years
George J. Panek: Writer/Editor	BS-Forest Management	11 years
Frances M. Payne: Writer/Editor	BA-English	25 years
Irene Stumpf: Graphics Artist	MS-Art	08 years
Stephanie Young: Graphics Design/Layout	AA-Art	10 years

IMPLEMENTATION

Terry Moody: Implementation Leader	AA-Forestry	18 years
Keith Murray: Lead Implementation Specialist	AA-Forestry	16 years
Mike Anderson: Implementation Specialist	AS-Forest Technology	10 years
Gene S. Arnesen: Timber Sale Appraiser	BS-Recreation Planning	11 years
Mary Ann Bowles: Timber Sale Appraiser	High School Diploma	15 years
Robert G. Clark: Implementation Specialist	AS-Forestry	13 years
Jerry English: Timber Sale Appraiser	AA-Forestry	14 years
Tom Hayward: Appraisal/Contracts	BS-Forest Management	14 years
Susan Knudsen-Obermeyer:Timber Sale Appraiser	High School Diploma	10 years
Kirk Lunstrum: Implementation Specialist	BS-Wildlife Management	12 years
William J. Menke: Implementation Specialist	AS-Forestry	15 years
Richard Solheim: Engineering	BS-Civil Engineering	22 years
Wendy Zustiak: Timber Sale Appraiser	High School Diploma	17 years

PUBLIC AFFAIRS

Steve Sorseth: Public Affairs Officer	BS-Forest Management	16 years
Harry Bonini: Assistant Public Affairs Officer	High School Diploma	08 years
Ellen Anderson: Information Assistant	High School Diploma	07 years

BUSINESS MANAGEMENT

Mary Jane Carver: Administrative Officer	Excellence/Management	13 years
Diane Williams: Support Services Supervisor	BS-Planning/Management	15 years
Patricia E. Suddath: Receptionist/Purchasing Liasion	Certificate-Office Mgmt.	33 years

OTHER SUPPORT PERSONNEL

Ken Adee, Dorothy Brooks, Joan Cully, Lorrane Filby, Wardman Fong, Judy Haigler, Loren Herman, Mike Hunt, Reino Jarvi, Charlene Johnson, Sue Leatherwood, Reba Lytjen, Doreen McClennen, Phil McCulley, Pat McKinney, Betty Nicholson, Ramon Novoa, Lana Rankin, Jim Shelton, Mary Tence, Shirley Winningham, Kelan Zerr, Rigdon Ranger District

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Herb Wick, District Ranger, Rigdon Ranger District
Rolf Anderson, Planning, Supervisor's Office, Willamette National Forest
Hal Legard, Fish/Wildlife Staff, Supervisor's Office, Willamette National Forest
Bob Leonard, Timber Staff, Supervisor's Office, Willamette National Forest
Mike Morris, NEPA Coordinator, Supervisor's Office, Willamette National Forest

LIST OF AGENCIES, ORGANIZATIONS, AND PERSONS TO WHOM COPIES OF THE STATEMENT HAVE BEEN SENT

Copies of the Shady Beach Fire Recovery Final Environmental Impact Statement (FEIS), Record of Decision, and Map Packet have been distributed to the following government agencies, libraries, organizations, and individuals. Additional copies are available upon request at the Willamette National Forest Supervisor's Office in Eugene, and the Rigdon Ranger District office in Oakridge. The distribution list for individuals receiving the Summary FEIS is extensive and is not included in this document.

FEDERAL AGENCIES AND OFFICIALS

- Advisory Council on Historic Preservation (ACHP)
  - Office of Architectural and Environmental Preservation, Washington, D.C.
- Agriculture, U.S. Department of (USDA)
  - Animal and Plant Health Inspection Service (APHIS)
    - Program Planning Staff, Hyattsville, Maryland
  - Forest Service
    - Board of Contract Appeals, Washington, D.C.
    - National Forests (Region 6)
      - Colville, Colville, Washington
      - Deschutes, Bend, Oregon
      - Fremont, Lakeview, Oregon
      - Gifford Pinchot, Vancouver, Washington
      - Malheur, John Day, Oregon
      - Mt. Baker-Snoqualmie, Seattle, Washington
      - Mt. Hood, Gresham, Oregon
      - Ochoco, Prineville, Oregon
      - Okanogan, Okanogan, Washington
      - Olympic, Olympia, Washington
      - Rogue River, Medford, Oregon
      - Siskiyou, Grants Pass, Oregon
      - Umatilla, Pendleton, Oregon
      - Umpqua, Roseburg, Oregon
      - Wallowa-Whitman, Baker, Oregon
        - Teepee Butte Recovery Project, Baker, Oregon
      - Wenatchee, Wenatchee, Washington
      - Willamette, Eugene, Oregon
      - Winema, Klamath Falls, Oregon
    - Office of the Chief, Washington, D.C.
    - Ranger Districts (Willamette National Forest)
      - Blue River, Blue River, Oregon
      - Detroit, Mill City, Oregon
      - Lowell, Lowell, Oregon
      - McKenzie Bridge, McKenzie Bridge, Oregon
      - Oakridge, Westfir, Oregon
      - Rigdon, Oakridge, Oregon
      - Sweet Home, Sweet Home, Oregon
    - Regional Offices
      - Region 1, Missoula, Montana
      - Region 2, Lakewood, Colorado
      - Region 3, Albuquerque, New Mexico

- Region 4, Ogden, Utah
- Region 5, San Francisco, California
- Region 6, Portland, Oregon
- Region 8, Atlanta, Georgia
- Region 9, Milwaukee, Wisconsin
- Region 10, Juneau, Alaska

Office of Equal Opportunity (OEO)
    Equal Employment Opportunity Commission, Washington, D.C.
    Office of Deputy General Counsel, Washington, D.C.
Office of General Counsel (OGC)
    Regional Attorney, Portland, Oregon
Pacific Northwest Forest/Range Experiment Station, Portland, Oregon
Pacific Northwest Research Station, Seattle, Washington
Rural Electrification Administration (REA)
    Assistant Administrator for Management, Washington, D.C.
    Environmental Police Office, Washington, D.C.
Soil Conservation Service (SCS)
    Environmental Coordinator of Ecology Sciences, Washington, D.C.
    District Conservationist, Eugene, Oregon
    State Conservationist, Portland, Oregon

Commerce, U.S. Department of (DOC)
- National Marine Fisheries Service
  - Habitat Conservationists Division, Seattle, Washington
  - Northwest Region, Portland, Oregon
- National Oceanic & Atmospheric Administration (NOAA)
  - Ecology and Conservation Division, Washington, D.C.

Defense, Department of (DOD)
- Chairman, Explosives Safety Board, Alexandria, Virginia
- Deputy Assistant Secretary of Defense, Washington, D.C.
- U.S. Air Force (USAF)
  - Department for Environment and Safety, Washington, D.C.
  - Deputy Assistant Secretary, Washington, D.C.
- U.S. Army (USA)
  - Corps of Engineers (COE)
    - Chief of Planning, North Pacific Division, Portland, Oregon
    - Headquarters, DAEN-ZCE, Washington, D.C.
    - Upper Willamette Valley Project, Lowell, Oregon
  - Engineering and Housing Support Center, Washington, D.C.
- U.S. Navy (USN)
  - Chief of Navy Operations, Arlington, Virginia

Department of Environmental Quality (DEQ)
- Office of the Director, Portland, Oregon
- Office of the Director, Seattle, Oregon

Energy, U.S. Department of (DOE)
- Office of NEPA Project Assistance, Washington, D.C.

Environmental Protection Agency (EPA)
- EIS Review Coordinator, Region 10, Seattle, Washington
- Federal Agency Liasion Division, Washington, D.C.
- Office of Environmental Review, Washington, D.C.
- Office of Federal Activities, Washington, D.C.

Federal Energy Regulatory Commission (FERC)
- Environmental Quality Advisor, Washington, D.C.

General Services Administration (GSA)
    Environmental Staff, Washington, D.C.
    Field Office Manager, Portland, Oregon
Health and Human Services, U.S. Department of (HHS)
    Departmental Environmental Office, Washington, D.C.
    Office of Special Programs Coordination, Washington, D.C.
Honorable Peter DeFazio, U.S. Representative
Honorable Mark Hatfield, U.S. Senator
Honorable Robert F. Smith, U.S. Representative
Housing and Urban Development, U.S. Department of (HUD)
    Office of Environment and Energy, Washington, D.C.
    Region 10 Environmental Officer, Seattle, Washington
Interior, U.S. Department of the (USDI)
    Bureau of Land Management (BLM)
        Office of the Director, Portland, Oregon
        Office of the District Manager, Eugene, Oregon
        Office of the District Manager, Salem, Oregon
    Director of Environmental Project Review, Washington, D.C.
    Fish and Wildlife Services
        Ecological Division, Portland, Oregon
Interstate Commerce Commission (ICC)
    Chief of Energy and Environment, Washington, D.C.
Labor, U.S. Department of (DOL)
    Assistant Secretary for Mine Safety & Health, Arlington, Virginia
    Assistant Secretary for Occupational Safety & Health, Washington, D.C.
Transportation, U.S. Department of (DOT)
    Environmental Division, Washington, D.C.
    Federal Aviation Administration (FAA)
        Northwest Region, Office of the Director, Seattle, Washington
    Federal Highway Administration
        Division Engineer, Vancouver, Washington
        Region 10, Environmental Program Manager, Portland, Oregon
        Office of Pipeline Safety, Washington, D.C.
    Federal Railroad Administration (FRA)
        Office of Hazardous Materials Safety Division, Washington, D.C.
        Office of Pipeline Safety, Washington, D.C.
    U.S. Coast Guard (USCG), Washington, D.C.

STATE AGENCIES AND OFFICIALS

Gail Achterman, Office of the Governor, Salem, Oregon
Honorable Neil Goldschmidt, Governor, Salem, Oregon
Intergovernmental Relations Division, Clearinghouse Coodinator, Salem, Oregon
Oregon Department of Fish and Wildlife, Corvallis, Oregon
Oregon Department of Fish and Wildlife, Portland, Oregon
Oregon Department of Fish and Wildlife, Salem, Oregon
Oregon Department of Fish and Wildlife, Springfield, Oregon
Oregon Department of Forestry, Salem, Oregon
Oregon Department of Forestry, Springfield, Oregon
Oregon Department of Land Conservation and Development, Salem, Oregon
Oregon State Parks and Recreation Department, Salem, Oregon

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Association of O and C Counties, Roseburg, Oregon
Douglas County Commissioners, Roseburg, Oregon
Lane County Commissioner John Ball, Eugene, Oregon
Lane County Commissioner Steve Cornacchia, Eugene, Oregon
Lane County Commissioner Elli Dumdi, Eugene, Oregon
Lane County Commissioner Bill Rogers, Eugene, Oregon
Lane County Commissioner Jerry Rust, Eugene, Oregon
Lane Council of Governments, Eugene, Oregon
Linn County Commissioners, Albany, Oregon
Oregon District Four Council of Governments, Corvallis, Oregon

ORGANIZATIONS

American Fisheries Society, Oregon Chapter, Corvallis, Oregon
Associated Oregon Loggers, Springfield, Oregon
Audubon Society, Tacoma, Washington
Cathedral Forest Action Group, Springfield, Oregon
Citizens Task Force, Eugene, Oregon
Forest Resources Relations, Camano Island, Washington
Friends of Cathedral Forest, Eugene, Oregon
Friends of the Earth, Seattle, Washington
Mountain States Legal Foundation, Denver, Colorado
National Forest Products Association, Washington, D.C.
National Wildlife Federation, Portland, Oregon
Native Plant Society of Oregon, Eugene, Oregon
Nature Conservancy, The, Portland, Oregon
Northwest Forestry Association, Portland, Oregon
Northwest Forestry Association, Springfield, Oregon
Northwest Timber Association, Eugene, Oregon
Oregon Archaeological Preservation Committee, West Linn, Oregon
Oregon Hunters Association, Eugene, Oregon
Oregon Natural Resources Council, Eugene, Oregon
Oregon Natural Resources Council, Portland, Oregon
Oregon Student Public Interest Research Group (OSPRIG), Portland, Oregon
Santiam Fish and Game Association, Albany, Oregon
Sierra Club, Eugene, Oregon
Sierra Club, Legal Defense Fund, San Francisco, California
Sierra Club, Northwest Representative, Seattle, Washington
Western Forestry and Conservation Association, Portland, Oregon
Western Wood Products Association, Portland, Oregon
Wilderness Society, The, Portland, Oregon
Wilderness Society, The, Seattle, Washington
Wildlife Management Institute, Firth, Nebraska
Wildlife Society, The, Corvallis, Oregon
Willamette Timbermen Association, Eugene, Oregon

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Eastern Washington University Library, Cheney, Washington
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Fern Ridge Community Library, Veneta, Oregon
Humboldt State University, Arcata, California
Junction City Public Library, Junction City, Oregon
Lewis and Clark College, Biology Department, Portland, Oregon
M. B. Wagner Research Library, Pacific Marine Technology, Duvall, Washington
Oakridge Public Library, Oakridge, Oregon
Oregon State University, Corvallis, Oregon
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Oregon State University, Forest Management Department, Corvallis, Oregon
Portland State University, Political Science Department, Portland, Oregon
Siuslaw Public Library, Florence, Oregon
Southern Oregon State College Library, Ashland, Oregon
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University of Florida, Library of Federal Documents, Gainesville, Florida
University of Massachusetts, Department of Forestry, Amherst, Massachusetts
University of Oregon, Association for Oregon Archaeology, Eugene, Oregon
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GLOSSARY

A

Acre Foot	A measure of water or sediment volume equal to the amount which would cover an area of 1 acre to a depth of 1 foot (325,851 gallons or 43,560 cubic feet).
Activity	A measure, course of action, or treatment that is undertaken to directly or indirectly produce, enhance, or maintain forest outputs or achieve administrative or environmental quality objectives.
Affected Environment	The biological, physical, and social environment that will, or may be changed by proposed actions.
Aggregate Recovery Percentage (ARP)	A measure of the hydrologic condition of a stand or watershed that indicates the likelihood of increasing the frequency of peak stream flows. This index measures the ability of a stand or watershed to modify snow packs. It is used only within the transitional snow zone, usually between 2,000 and 4,000 feet in elevation.
Allowable Sale Quantity (ASQ)	The quantity of timber that may be sold on the Willamette National Forest from the area of suitable land for timber management once a Forest Plan is implemented.
Alluvium	Stream deposits of gravelly sand, silt, or clay.
Alternative	A combination of management prescriptions applied in specific amounts and locations to achieve a desired management emphasis as expressed in goals and objectives. One of several policies, plans, or projects proposed for decision making. An alternative need not substitute for another in all respects.
Ambient particulate concentrations	A concentration of particulate matter suspended in the atmosphere, generally produced by smoke. See Oregon State Smoke Management Implementation Plan for more complete information.
Anadromous Fish	Fish which mature and spend much of their adult life in the ocean, returning to inland waters to spawn; i.e., salmon, steelhead.
Analysis Area	A delineated area of land analyzed to determine possible responses to and effects from proposed management practices.
Analysis File	Documents and files that contain detailed information, site specific prescriptions, records of the analysis process, and decisions

	made in developing the Shady Beach Fire Recovery Project Environmental Impact Statement, and which are available at Rigdon Ranger District.
Andesite	A fine-grained volcanic rock composed essentially of plagioclase feldspars and ferro-magnesian minerals. (Similar to basalt).
Angle of Internal Friction	The natural angle of the failure plane when the soil is stressed to failure.
Appropriated Funds	Monies authorized by an act of Congress which permit Federal agencies to incur obligations and to make payments out of the U. S. Treasury for specified purposes.
Aspect	The direction a slope faces.

B

Background	A term used in visuals management - the distant part of a landscape. The seen, or viewed, area located from 3 or 5 miles to the horizon from the viewer.
Bald Eagle Management Area (BEMA)	A specific area set aside for managing or maintaining habitat for bald eagle.
Basal Area	The area of the cross-section of a tree near its base, usually at breast height and inclusive of bark.
Basalt	An extrusive rock of volcanic origin; fine grained, dark colored. Very similar to andesite.
Bedrock	The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.
BEHAVE	A set of interactive computer programs that 1) permits construction of site-specific fire behavior fuel models and 2) allows state-of-the-art fire prediction techniques for estimating wildland fire potential under various fuel, weather and topographic situations.
Benchmark	Reference points that define the bounds within which feasible management alternatives can be developed. Benchmarks may be defined by resource output or economic measures.
Big Game	Those species of large mammals normally managed as a sport hunting resource, under state regulations (deer, elk, bear, and mountain lion).

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Board Foot (BF)	A unit of measurement represented by a board 1 foot square and 1 inch thick.
Bole	The vertical main stem of a tree utilized by the tree to support the branches, needles, and leaves.
Breccia	Rock composed of angular fragments in a finer groundmass.
Broadcast Burn	Allowing a controlled fire to burn over a designated area within well-defined boundaries, either for reduction of fuel hazard or a silvicultural treatment, or for a combination of both.
Browse	Twigs, leaves, and young shoots of trees and shrubs on which animals feed; in particular, those shrubs which are utilized by big game animals for food.
Browse Cutback	The act of cutting down brush or hardwood vegetation when it is too tall, decadent, or low in nutritional value to be of much value to browsing animals, usually big game. This cutback allows the vegetation to resprout and become more available and of higher quality.

C

Cambium	Growing (generative) layer between the xylem and phloem. **Living Cambium** - This is almost white, usually moist and slippery to the touch, and does not easily separate from the woody tissue. **Dead Cambium** - Dead cambium is dry and discolored (usually brown to black). Cells have lost plasticity and the inner bark separates readily from the wood. Dead tissue may have a sour/fermented odor.
Canopy	The more or less continuous cover of branches and foliage formed collectively by the crown of adjacent trees and other woody growth.

Canopy Closure	A measure of the percent of horizontal area occupied by the collective tree crowns in a forest stand.
Cavity Excavators	Birds that excavate and/or nest in cavities in standing live, dead, or down trees.
Cavity Nester	Birds or mammals which build nests in excavated cavities in standing live, dead, or down trees.
Clearcutting	A harvesting method in which all trees are felled in one cut. It prepares the area for a new, even-aged stand. The area harvested may be a patch, stand, or strip large enough to be mapped or recorded as separate age class. Regeneration is obtained through natural seeding, through planting, or direct seeding.
Climax	(Vegetation) The culminating stage in plant succession for a given site where the composition of the vegetation has reached a highly stable condition,over time, and perpetuates itself unless disturbed by outside forces.
Colluvium	Soil material or rock fragments moved downslope by gravitational force in the form of soil creep, slides, and local wash.
Commercial Forest Land (CFL)	Forest land which is producing or capable of producing successive crops of wood products and has not been reserved or deferred.
Commercial Thinning	The removal of some merchantable size trees from a stand in order to accelerate the annual growth of the residual trees, and by suitable selection, improve the form of the trees that remain.
Compaction	The packing together of soil particles by forces exerted at the soil surface, resulting in increased soil density and reduced soil porosity.

Comparison by Issue

COMPARISON BY ISSUE
SLUG HABITAT / SLIME CAPACITY

NON-ISSUES	R	S	T
BANANA SLUGS			
----forage/hiding/thermal cover* (ratio)	65-9-15	62-11-17	52-2-21
----Slime Quality Index* (SQI)	0.45	0.41	0.50
SLIME DEPENDANT SPECIES			
----Suitable Habitat (acres)			
........Northern Spotted Banana Slug*	2861	2389	1950
........Pileated Woodslug*	496	741	837
........Green Pine Slug*	160	248	194
........Bottled Nose Slug*	581	340	416
----Slug Habitat Index* (SHI)	0.21	0.14	0.91
Primary Cavity Slug Excavator Habitat*			
% pop. capacity year 0 (slug years)	4.62	4.92	5.19
% pop. capacity year 30 (slug years)	3.9	4.67	4.29
THREATENED & ENDANGERED SPECIES			
----Bald Slug Potential Nest Sites* (no.)	4	8	6
----Peregrine Slug (Attack Slug) Habitat* (acres)	520	520	520
----W. Oregon Pond Slug* (cu.ft slime/slug yr)	120	234	189
----Oregon Chubslug* (area slimed/acre/slug yr)	.82	.75	.94
----Plant Species of Slug forage* (acres)	3461	3780	3524
Riparian Slime Dependant Species* (acres impacted)	1240	430	890

1 slug year = 2 dog years = 14 human years

* Effects Common to No Alternative

Conifer

Evergreen trees and shrubs with cones.

Council on Environmental Quality (CEQ)

An advisory council to the President established by the National Environmental Policy Act of 1969. It reviews Federal programs for their effect on the environment, conducts environmental studies, and advises the President on environmental matters.

Cover

Vegetation used by wildlife for protection from predators, for amelioration of weather conditions, or for reproduction.

Crown Layer

The cover formed by the top branches of trees in a forest. All the layers below comprise the canopy:

First Layer - dominant and codominant trees.
Second Layer - trees with heights between 40 and 75 percent of the height of the codominant trees.
Third Layer - Trees with heights less than 40 percent of codominant trees.

Cubic Feet Per Second (CFS)	A unit of measure applied to fluid flow. A rate of discharge.
Cultural Resources	The physical remains of human activity (artifacts, ruins, burial mounds, petroglyphs, etc.) and conceptual content or context (as a setting for legendary, historic, or prehistoric events, as a scared area of native peoples, etc.) of an area for prehistoric or historic occupation.
Cumulative Effect	The effect on the environment which results from incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. (40 CFR 1508.7).
Current Forest Plan/FEIS	Willamette National Forest Final Environmental Statement, Multiple-Use Land Management, Timber Management Plan of 1977.

D

Dacites	Dark volcanic flow rock similar to basalt and andesite.
Debris Avalanche	Rapid flow of a mass of soil, water, and woody material down a steep draw, leaving a long scar of bare soil and rock.
Debris Torrent	A rapid flow of water-charged debris through a stream channel. This event is usually initiated by a debris avalanche entering the stream channel.
Developed Recreation	Recreation that occurs where improvements enhance recreation opportunities and accommodate intensive recreation activities in a defined area.
Developed Recreation Sites	Relatively small, distinctly defined area where facilities are provided for concentrated public use, i.e., campgrounds, picnic areas and swimming areas.
Diameter at Breast Height (DBH)	The diameter of a standing tree at a point 4 feet, 6 inches measured from ground level on the uphill side.
Direct Effects	Effects on the environment which occur at the same time and place as the initial cause or action.
Discount Rate	An interest rate that reflects the cost or time value of money. It is used in discounting future costs and benefits.

Discounting	An economic adjustment for the time value of money; mathematical reduction of costs and/or benefits which occur in the future to the present time for purposes of comparison.
Dispersed Recreation	Outdoor recreation which occurs outside of developed sites in the unroaded and roaded Forest environment, i.e., hunting, backpacking, and berry picking.
Dissolved Oxygen (DO)	The amount of oxygen dissolved in water expressed in parts per million (ppm) by weight, or miligrams per liter (mg/l).
Diversity	The distribution and abundance of different plant and animal communities and species within an area.
Draft Environmental Impact Statement (DEIS)	A draft publication of the Environmental Impact Statement for a proposed action which the public can assess for the purpose of sending responses to the responsible official. This draft and the public input precede the publication of the Final Environmental Impact Statement. The format and process for these documents is outlined by the National Environmental Policy Act.
Duff	An organic surface soil layer below the litter layer in which the original form of plant and animal matter cannot be identified with the unaided eye.

E

Economic Efficiency	The usefulness of inputs (costs) to produce outputs (benefits) and effects when all costs and benefits that can be identified and valued are included in the computations. Economic efficiency is usually measured using present net value, though use of benefit-cost ratios and rates-of-return may sometimes be appropriate.
Economics	The study of how scarce resources, goods, and services are allocated among competing uses.
Ecosystem	A complete, interacting system of organisms considered together with their environment (for example; a marsh, a forest, or a lake).
Edge	The area where plant communities meet or where successional stage of vegetative conditions within plant communities come together, i.e., field and woodland, forest and meadow.
Effects	Physical, biological, social and economic results (expected or experienced) resulting from natural events or management activities. Effects can be direct, indirect and cumulative.

Endangered Species	Any species, plant or animal, which is in danger of extinction throughout all or a significant portion of its' range. Endangered species are identified by the Secretary of the Interior in accordance with the 1973 Endangered Species Act.
Endemic Plant	A plant confined to a certain area with a comparatively restricted geographic distribution.
Environment	The aggregate of physical, biological, economic, and social factors affecting organisms in an area.
Environmental Analysis	An analysis of alternative actions and their predictable environmental effects, including physical, biological, economic, and social consequences and their interactions; short- and long-term effects; direct, indirect, and cumulative effects.
Environmental Assessment (EA)	A concise public document which serves to: (a) Briefly provide sufficient evidence and analysis for determining whether to prepare an Environmental Impact Statement or a Finding of No Significant Impact; (b) Aid an agency's compliance with the National Environmental Policy Act when no Environmental Impact Statement is necessary; (c) Facilitate preparation of an Environmental Impact Statement when necessary.
Environmental Impact Statement (EIS)	A detailed statement in which a major Federal action which significantly affects the quality of the human environment is described, alternatives to the proposed action provided, and effects analyzed.
Erosion	The processes whereby earth or rocky material is worn away by natural forces such as wind, water or ice and removed from any part of the earth's surface. Accelerated erosion is much more rapid than normal, natural, or geologic erosion, primarily as a result of the influence of activities of man, animals, or natural catastrophes.
Erosion Index	A subdrainage sensitivity/risk index developed from data obtained from the Shady Beach Fire Recovery Project erosion analysis model. This is a relative index of the potential for eroded material delivery to streams. Erosion Index is used along with fisheries potential to identify high risk or sensitive subdrainages that will require additional mitigation and extensive monitoring of water quality during project implementation.
Evapotranspiration	Water lost to the atmosphere from soil, large woody material on the ground, and plant surfaces as well as the water transpired from the body of a plant during the photosynthetic process.

Expected Merchantable Volume

See Harvest Volumes

F

Fire Intensity

The following are levels of soil-fire intensity:

Lightly burned or low intensity: The surface litter, rotten wood, and other woody debris is often charred but not completely consumed by the fire. The lower duff and observable woody debris in the organic layer is partially burned. Logs are not deeply charred. Mineral soil is not changed in color. Hydrophobic soil conditions rarely occur. Root crowns and surface roots of grasses, herbs, and woody understory species show a high potential for resprouting. Estimated flame lengths are less than 4 feet. Mortality by destruction of the vascular cambium included those trees from 2 to 4 inches DBH. An area classified as lightly burned generally has less than 2 percent severely (high) burned and less than 15 percent moderately burned. (Tree mortality class: Low)

Lightly burned or moderately low intensity: The surface litter, rotten wood, and other woody debris is generally partially burned with small consumed areas. The lower duff is usually partially consumed. Some logs may be deeply charred. Mineral soil is not usually changed in color. Hydrophobic soil conditions generally do not exist. Root crowns and surface roots of grasses, herbs, and woody understory species are partially to wholly consumed slightly inhibiting re-sprouting. Estimated flame lengths are 4 to 6 feet (often longer). Mortality by destruction of the vascular cambium includes trees from 4 to 18 inches DBH. An area classified as moderately-low burn intensity generally has less than 5 percent severely (high) burned and 15 to 50 percent moderately burned. (Tree mortality class: Moderate)

Moderately burned or moderate intensity: The surface litter, rotten wood, and other woody debris is partially to wholly consumed by the fire. The lower duff is partially to wholly consumed. Logs may be deeply charred. Mineral soil under the ash is not appreciably changed in color. Hydrophobic conditions may occur. Root crowns and surface roots of grasses, herbs, and woody understory species are partially, to wholly consumed inhibiting re-sprouting. Estimated flame lengths are 4 to 8 feet. Mortality resulting from destruction of the vascular cambium includes trees of 18 inches or greater DBH. An area classified as moderately burned generally has 10 percent or less severely (high) burned, 50 to 90 percent moderately burned, and the remainder lightly burned. (Tree mortality class: High)

Severely burned or high intensity: Surface and lower duff is completely consumed. Logs deeply charred or consumed. The top layer of mineral soil has generally changed in color, usually to reddish color and blackened in the next half inch from organic matter charring by heat conducted through the top layer. Hydrophobic soil conditions are common. Surface rocks often split from heat. Root crowns and surface roots of grasses, herbs, and woody species usually destroyed and resprouting very limited. Estimated flame lengths are in excess of 6 feet. Severe intensity is more closely related to fuel loading concentrations and resulting duration and intensity. An area classified as severely burned generally has more than 10 percent severely (high) burned, more than 80 percent moderately burned, and the remainder lightly burned. (Tree mortality class: Uninventoried)

FIRE INTENSITY

Characteristics	Low	Moderately-Low	Moderate	High
Surface litter, rotten wood, and other woody debris	Commonly charred but not completely consumed	Partially consumed	Partially to wholly consumed	Completely consumed
Lower Duff	Partially consumed	Partially consumed	Partially to wholly consumed	Completely consumed
Logs	Not deeply charred	Some logs may be completely charred	Usually completely charred	Deeply charred to consumed
Mineral soil color	Not changed in color	Not usually changed in color	No appreciable change in color	Generally changed to reddish color black in next 1/2 inch
Hydrophobic soil conditions	Rarely occurs	Generally does not occur	May occur	Commonly occurs
Root crowns and surface roots of grasses, etc.	High potential for resprouting	Slightly inhibited resprouting	Inhibited resprouting	Resprouting limited
Flame lengths (ft)	<4	4-6	4-6	6+
Vascular cambium layer effect on trees of dbh (in)	2-4	4-18	18+	Related to fuel loading, duration, and intensity
Aerial extent (%) ....High ....Moderate ....Low	 <2 <15 85-100	 <5 15-50 45-85	 <10 50-90 0-50	 >10 >80 0-10
Tree Mortality Class	Low	Moderate	High	Uninventoried

Floodplain	The lowland and relatively flat areas adjoining inland and coastal waters, including, at a minimum, that area subject to a 1 percent or greater chance of flooding in any given year.
Forage	All browse and non-woody plants available to wildlife for feeding.
Forage/Cover Ratio	The ratio of tree cover (usually conifer types) to foraging areas (natural openings, clearcuts, etc.).
Forb	Any herbaceous plant other than true grasses, sedges, or rushes.
Forage Areas	Vegetated areas with less than 60 percent combined canopy closure of tree and tall shrub (greater than 7 feet in height).
Foreground	A term used in visual management to describe the area immediately adjacent to a high-value scenic area, recreation facility, or forest highway. (See Background, Middleground).
Forest and Range Land Renewable Resources Planning Act of 1974 (RPA)	An act of Congress which requires the assessment of the Nation's renewable resources and the periodic development of a national renewable resources program.
Forest Land	Land at least 10 percent occupied by forest trees or formerly having had such tree cover and not currently developed for non-forest use.
Forest Plan	See Current Forest Plan/FEIS or Proposed Forest Plan/DEIS.
Forest Stand	See Stand.
Forest Supervisor	The official responsible for administering the National Forest System lands in a Forest Service Administrative unit, which may consist of one or more National Forests. The responsible official for the Shady Beach Fire Recovery Project.
FORPLAN	A linear programming system used for developing and analyzing Forest planning alternatives.
Fuel Model	A stylized description of a fuel bed which aids in describing specific fuel characteristics in reference to predicting fire behavior.
Fuels	All material in the forest that may burn under dry conditions. This includes living plants, dead woody material, duff, and litter.
Fuels Management	Manipulation or reduction of fuels to meet Forest protection and management objectives while preserving and enhancing environmental quality.
Fuels Treatment	The re-arrangement or disposal of natural or activity (logging residue) fuels to reduce the fire hazard.

Full-time equivalent (FTE)	Full-time job which equals 2,080 hours of work per year.

G

General Forest	Commercial forest land that is managed for optimal and sustainable levels of timber production. These timber products are provided while also providing animal forage and public use.
Geographic Information System (GIS)	A modeling system using computer mapping and data tables to generate layers of topographic, biologic and environmental information that can be combined in a number of ways.
Gross Merchantable Volume	See Harvest Volumes.
Gross Volume	See Harvest Volumes.

H

Habitat	A place where a plant or animal naturally or normally lives and grows.
Habitat Diversity	Distribution and abundance of plant and wildlife habitats.
Habitat Quality Index (HQI)	An index indicating the relative quality of big game forage and cover habitat in terms of distribution and size of forage areas, forage quality, cover quality, and amount of disturbance by road traffic.
Habitat Type	An aggregation of all land areas potentially capable of producing similar plant communities at climax.
Hard Snag	See Snag.
Harvest Method	A combination of interrelated actions whereby forests are tended, harvested, and replaced. The combination of management practices used to manipulate the vegetation results in forests of distinctive form and character. Harvest cutting methods are classified as even-aged or uneven-aged. For example, even-aged harvest cutting methods are clearcutting, shelterwood and seed tree cutting.
Harvest Volumes	**Expected Merchantable Volume**: The volume used in the economic efficiency analyses. The economic efficiency analyses are based on an assumed 2 year salvage operation. All volume removed in the first year (1989) is assumed to have no deterioration loss. Volume removed in the second year (1990) is assumed to have a 10 percent volume loss due to deterioration as a result of

the fire. Therefore, all volumes removed in Year 1 are synonymous with the definition for gross merchantable volume. However, all volumes removed in Year 2 are reduced by another 10 percent to account for deterioration; these volumes are 70 percent of gross volumes rather than 80 percent.

Gross Merchantable Volume: All volume that has some marketable or merchantable value, either in scaled board foot value or in per acre material (PAM) value which includes chipable volume. On this project, this is an average of 40 percent defect and breakage for all harvest units. One-half of this defect volume (i.e. 20 percent of gross volume) has PAM value. Therefore, 80 percent of the gross volume is equal to the gross merchantable volume.

Gross Volume: 100 percent of timber volume, (includes all defect and breakage).

Net Merchantable Volume: The amount of volume that has board foot or scaled value. For this project, 60 percent of gross volume is the net merchantable volume or 75 percent of gross merchantable volume is the net merchantable volume.

Helicopter Logging	Logging systems using helicopters where logs are lifted vertically and yarded free and clear of the ground.
Hiding Cover	Trees or other vegetation of sufficient height and density to conceal animals from view at 300 feet.
Hills Creek Bald Eagle Management Plan, (1983)	A management plan identifying habitat areas to be managed for bald eagles and which provides guidelines for general management activities which are permissible within these habitat areas. The National Forest Management Act, 1976 directs management plans be developed for habitat areas on National Forest lands for species that are federally listed as threatened or endangered.

I

Impacts	See Effects
IMPLAN	Impact Analysis Planning, an economic input-output model. This model evaluates changes in jobs, incomes, and outputs resulting from changes in technology of and/or final consumer demand changes for exporting (basic) industries.
Incidental Green	Live trees removed in alternatives B, C and F which includes those trees on 1) landing locations, 2) cable corridors, 3) guy/tail tree anchors, 4) hazard trees during logging activities, 5) logical

unit boundary locations along topographic features such as ridges, streams (for SMUs), and roads.

Incised Stream Channel	A stream channel which has cut into the surrounding terrain to create markedly steeper slopes adjacent to the stream.
Indicator Species	Species identified in a planning process that are used to monitor the effects of planned management activities on viable populations of wildlife and fish.
Insolation	Exposure to sunlight; solar radiation that has been received.
Interior Forest Habitat	Forest habitat found deep within a large forested area, unaffected by the climate and non-forest species that occur along the edge of a forest
Interior Species	Those species of fauna and flora adapted to the habitat characteristics found within the forest interior, that area that is not affected by the different envronment of the forest edge.
Interior Habitat Index (IHI)	An index of habitat quality for species that depend upon interior forest habitat for survival or reproduction.
Interdisciplinary Team (ID) Team	A group of individuals with different training assembled to solve a problem or perform a task. The team is assembled out of recognition that no one scientific discipline is sufficiently broad to adequately solve the problem. Through interaction, participants bring different points of view to bear on the problem.
Irretrievable	Foregone or lost production, harvest, or use of renewable natural resources. For example, when fire destroys a tree plantation, the effect is irretrievable, but the loss of site productivity as measured by the presence of trees is not irreversible.
Irreversible	The removal of resources such that they cannot be produced again This applies most commonly to non-renewable resources such as minerals or cultural resources or to resources such as soil productivity that are renewable only over long periods of time. Loss of renewable resources can also be irreversible as in the replacement of a forest with a road.
Issue	See Public Issue.

J

Jackson Turbidity Unit (JTU)	A measure of the ability of fine sediment in water to scatter light generated by a candle.

K

Key Indicator	A quantitative measure of how an issue is addressed.
Knutson-Vandenburg Act of 1930 (K-V)	A law which provides for collection of money from the sale of timber to be used to fund reforestation and the protection and improvement of the Forest renewable resources within a sale area.

L

Lahar	A geologic deposit formed from volcanic mudflows.
Land Allocation	The decision to use land for various resource management objectives in order to best satisfy the issues, concerns, and opportunities identified during the planning process to meet assigned Forest output targets.
Large Woody Debris (LWD)	All or portions of tree stems, roots or branches that enter a stream channel. The material must be large enough to be stable and remain in place by wedging or "keying" into the stream banks. This material provides important structural habitat for fish by modifying the hydraulics of the stream, creating pools. It can control storage of sediment and organic material and provides cover from predators and high stream flows. This woody material also serves as a long-term food base for fish prey species.
Large Woody Material	Standing and down logs , that range from rotting material to green trees. This material should be at least 16 inches in diameter on the large end and contains 40 cubic feet of volume. This woody material provides habitat for small mammals and amphibians and is an important component of the forest nutrient cycling system.
Linear Programming	A mathematical method used to determine the optimal distribution of limited resources between competing demands when both the objective (i.e., profit or cost) and the restrictions on its attainment are expressible as a system of linear equalities or inequalities (i.e., $y=a+bx$).
Logical Unit Boundary	A unit when laid out for harvest that uses topographic features to facilitate management activities for present and future needs. Major elements for determining unit design include road location, yarding settings, topographic features, and fuel treatment methods/needs.

M

Management Direction	A statement of multiple-use and other goals and objectives, along with the associated management prescriptions and standards and guidelines to direct resource management.
Management Requirements (MR)	Specific requirements consistent with 36 CFR 219.27 that are designed to prevent damage to forest resources beyond a minimum threshold established by law or regulation.
Mass Wasting	All geologic processes in which earth materials move downslope, either slowly or quickly, by gravitational forces. (includes debris torrents, debris avalanches, landslides and slumps).
Mature and Over Mature (MOM)	An inventory of the Willamette National Forest designed to identify individual stand attributes that describe mature and overmature stand conditions.
Mature Timber	Individual trees or stands of trees that in general are at their maximum (mean annual) growth rate expressed as height, diameter, and volume growth.
Middleground	A term used in visuals management referring to the visible terrain beyond the foreground where individual trees are still visible but do not stand out distinctly from the stand (See Foreground and Background.) The area is located from 1/4-1/2 to 3-5 miles from the viewer.
Mitigate	To lessen the severity.
Mitigation	Actions to avoid, minimize, reduce, eliminate, replace, or rectify the impact of a management practice. The definition in NEPA includes: (a) Avoiding impact altogether by not taking a certain action or parts of an action, (b) Minimizing impacts by limiting the degree or magnitude of the action and its implementation. (b) Rectifying the impact by repairing, rehabilitating, or restoring the affected environment, (d) Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action, (c) Compensating for the impact by replacing or providing substitute resources or environment.
Modification	See Visual Quality Objective (VQO).
Monitoring and Evaluation	The periodic evaluation on a sample basis of Forest Plan management practices to determine how well objectives have been met and how closely management standards have been adhered to.

Multiple-Use	The management of all the various renewable resources of the National Forest System so that they are utilized in the combination that will best meet the needs of the American people; making the most judicious use of the land for some or all of these resources or related services over areas large enough to provide sufficient latitude for periodic adjustments in use to conform to changing needs and conditions; that some lands will be used for less than all of the resources; and harmonious and coordinated management of the various resources, each with the other, without impairment of the productivity of the land, with consideration being given to the relative values of the various resources, and not necessarily the combination of uses that will give the greatest dollar return or the greatest unit output.

N

National Environmental Policy Act (NEPA)	An act which encourages productive and enjoyable harmony between humans and their environment; promotes efforts to prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of humans; enriches the understanding of the ecological systems and natural resources important to the Nation; and establishes a Council on Environmental Quality.
National Forest Management Act (NFMA)	A law passed in 1976 as amendments to the Forest and Rangeland Renewable Resources Planning Act (1974) that requires the preparation of Regional and Forest plans and the preparation of regulations to guide that development.
NEPA Process	An interdisciplinary process, mandated by the NEPA, which concentrates decision making around issues, concerns, alternatives and the effects of alternatives on the environment.
Nephlometric Turbidity Unit (NTU)	A measure of the scattering of electrically generated light in water by very fine-grained suspended solids.
Net Benefit (NB)	The difference between revenues generated by forest resource use/management in a management alternative and all costs associated with producing these revenues. There is no discounting applied to the calculation.
Net Merchantable Volume	See Harvest Volumes.
NETWORK	A transportation model which is a network analysis algorithm developed by John Sessions at Oregon State University. It contains cost information for different ways to move timber from potential harvest units to the mill. Costs are modeled for yarding, hauling,

	road maintenance and road construction/reconstruction for each alternative.
No Action Alternative	An alternative where no activity would occur. Development of a No Action alternative is required by regulations implementing the National Environmental Policy Act (NEPA) (40 CFR 1502.14). The no action alternative provides a baseline for estimating the effects of other alternatives.

O

Old-Growth	A stand or forest defined by Franklin et al. (1985) as generally containing the following characteristics: 2 or more species with a wide range of ages and tree sizes; 8 or more Douglas-fir per acre (in some environments western redcedar or ponderosa pine are replacements for Douglas-fir) that are bigger than 32 inches in diameter or over 200 years old; 12 or more trees per acre of a shade tolerant species are present that are bigger than 20 inches in diameter and over 15 feet tall; 15 or more tons per acre of logs including four pieces per acre bigger than 24 inches and 50 feet or longer. An old-growth stand contains mature and overmature trees in the overstory.
Old-Growth Habitat	Old-growth of the type, condition and size that satisfy the needs of and provide old-growth characteristics for plant and animal species.
Optimal Thermal Cover	Habitat for deer and elk that provides snow interception, temperature moderation, and maintenance forage. This type of cover has a muti-leveled canopy in which the overstory canopy exceeds 70 percent crown closure and dominant trees generally exceed 21 inches DBH.
Oregon and California Funds (O&C)	Payments made from timber sale receipts from timber harvested on lands which were repossessed by the U. S. Government from the Oregon and California Railroad Company in I916. Payments are made to counties where these lands occur in lieu of taxes.
Organic Matter	The organic fraction of the soil that includes plant and animal residues at various stages of decomposition, cells and tissues of soil organisms, and substances synthesized by the soil plant and animal populations.
Overmature Timber	Individual trees or stands of trees that, in general, are beyond their maximum mean annual growth rate in terms of the physiological processes expressed as height, diameter and volume growth.
Overstory	That uppermost canopy layer of the forest when there is more than one layer of vegetation.

P

Partial cut	An intermediate harvest in which dead, damaged, or trees susceptible to insects or disease are removed to improve the condition of the remaining trees. Unaffected healthy trees remain after harvest is complete.
Partial retention	See Visual Quality Objectives.
Particulates	Small particles suspended in the air and generally considered pollutants.
Payments to Counties	Based on the 25 Percent Fund Act of 1908 and the Weeks Law of 1911, 25 percent of all revenues returned to the Federal treasury from the sale of resources or user fees collected from Forest Service lands are returned to counties on a per acre basis. In the State of Oregon, 75 percent of these funds must be allocated to the county road budget and 25 percent is contributed to public schools.
Per Acre Material (PAM)	Logs that are not sound enough to produce lumber but which can produce wood chips, low quality veneer, and other wood by-products.
Perennial Stream	A stream which normally flows throughout the year. (See also Stream Classes: Class I: Perennial or intermittent streams.
Phloem	The inner bark of a tree; the principal tissues involved in the distribution of complex carbohydrates (elaborated foodstuffs).
Pileated Woodpecker Habitat Area (PWHA)	A habitat area designated to support a minimum of one pair of pileated woodpeckers.
Pine Marten Habitat Area (PMHA)	A habitat area designated to support a minimum of one pair of pine martens.
Policy	A guiding principle upon which is based a specific decision or set of decisions.
Precommercial thinning	The selective felling, deadening, or removal of trees in a young stand primarily to maintain or accelerate diameter increment on the remaining stems, to maintain a specific stocking or stand density range, and to improve the vigor and quality of the trees that remain.
Predicted Mortality (PM)	Trees expected to die as a result of being subjected to heat sufficient to kill the cambium.

Prescribed Burning	The intentional application of fire to wildland fuels in either their natural or modified state under such conditions as allow the fire to be confined to a predetermined area to produce the intensity of heat and rate of spread desired to obtain planned objectives (i.e., silviculture, wildlife management, etc.).
Prescribed Fire	A fire burning under specified conditions which will accomplish planned objectives in strict compliance with an approved plan and the conditions under which the burning takes place and the expected results are specific, predictable, and measurable.
Present Net Value (PNV)	A value that represents the dollar difference between the discounted value of all outputs to which monetary values are assigned and discounted costs of producing these outputs.
Productivity	See Site Productivity.
Proposed Forest Plan/DEIS	Proposed Land and Resource Management Plan, Willamette National Forest and Draft Environmental Impact Statement (1987).
Public Involvement	A Forest Service process designed to broaden the information base upon which agency decisions are made by (1) informing the public about Forest Service activities, plans, and decisions, and (2) encouraging public understanding about and participation in the planning processes which lead to final decision making.
Public Issue	A subject or question of widespread public interest identified through public participation relating to management of the National Forest.
Pyroclastic	A general term applied to rocks formed from volcanic material that has been explosively or aerially ejected from a volcanic vent.

R

Ranger District (RD)	Administrative subdivision of the Forest, supervised by a District Ranger who reports to the Forest Supervisor.
Receipts (Revenues)	Money collected from timber stumpage, livestock grazing, campgrounds, special use permits, and oil and gas lease rentals and royalties, and returned to the federal treasury.
Receipt Shares	See Payments to Counties
Record of Decision	A document separate from, but associated with, an Environmental Impact Statement that publicly and officially discloses the responsible official's decision on the proposed action.

Recreation opportunities	The combination of recreation settings, activities, and experiences provided by the Forest.
Recreation Visitor Day	Recreation use of National Forest sites, or areas of land or water, which aggregates 12 visitor-hours. May consist of one person for 12 hours, 12 people for 1 hour, or any equivalent combination of continuous or intermittent recreation use by individuals or groups.
Reforestation	The natural or artificial restocking of an area with forest trees; includes measures to obtain natural regeneration, as well as tree planting and seeding. The work is done on National Forests to produce timber and other forest products, protect watershed functioning, prevent erosion, and improve other social and economic values of the forests, such as wildlife, recreation, and natural beauty.
Regeneration	The renewal of a tree crop, whether by natural or artificial means. Also the young tree crop (seedlings and saplings) itself.
Regeneration Cut	A silvicultural treatment in which a stand of trees will be harvested for the purpose of creating a new stand.
Regional Guide	A document that guides natural resource management activities and establishes management standards and guidelines for National Forest System lands of a given Region.
Regeneration Harvest	See Regeneration Cut.
Retention	See Visual Quality Objectives (VQO).
Riparian Areas/Habitats	Areas with distinctive resource values and characteristics that are comprised of an aquatic ecosystem and adjacent upland areas that have direct relationships with the aquatic system. This includes floodplains, wetlands, and all areas within a horizontal distance of approximately 100 feet from the normal high water line of a stream channel, or form the shoreline of a standing body of water.
Road Purchaser Credit (RPC)	The amount allowed for the construction of new roads to access a timber sale area. RPC's reduce the stumpage receipts to the Federal Treasury by the RPC amount.
Rotation	The planned number of years between the formation or the regeneration of a crop or stand of trees and its final cutting at a specified stage of maturity.

Rotation age	The age of a stand when harvested at the end of a rotation.

S

Salvage Harvest	The cutting of trees that are dead, dying, or deteriorating (e.g., because they are overmature or materially damaged by fire, wind, insects, fungi, or other injurious agents) before they lose their commercial value as sawtimber.
Scoping	The procedures by which the Forest Service determines the extent of analysis necessary for a proposed action, i.e., the range of actions, alternatives, and impacts to be addressed, identification of significant issues related to a proposed action, and establishing the depth of environmental analysis, data, and task assignments needed.
Scenic Influence II Lands	A land allocation in the Current Forest Plan/FEIS. See Visual Quality Objectives, Partial Retention.
Second-growth	Forest growth that has become established after some drastic disturbance (for example, regeneration cutting, serious fire, or insect attack) of the previous forest growth.
Sediment	Solid material, both mineral and organic, that is in suspension, being transported, or has been moved from its site of origin by air, water, gravity, or ice.
Seedling/Sapling	A size category for forest stands in which trees less than 5 inches in diameter are the predominant vegetation.
Sensitive Species	Those plant or animal species which are susceptible or vulnerable to habitat alterations from management activities. Species that have appeared in the Federal Register as proposed for classification and are under consideration for official listing as endangered or threatened species, that are on an official state list, or that are recognized by the Regional Forester as needing special management to prevent their being placed on Federal or state lists.
Shelterwood cut	The removal of a stand of trees through a series of cuttings designed to establish a new crop with seed and protection provided by a portion of the stand.
Significant	As used in NEPA, an effect that has important context and intensity. Context means that the significance of an action must be analyzed in several contexts such as society as a whole, and the affected region, interests, and locality. Intensity refers to the severity of impacts (40 CFR 1508.27).

Silviculture	The art and science of growing and tending forest vegetation, i.e., controlling the establishment, composition, and growth of forests, for specific management goals.
Site Productivity	Production capability of a specific area of land.
Slash	Woody debris left after logging, pruning, thinning, brush cutting, or other management activities and/or material that accumulates on the forest floor as a result of storm, fire, or other damage.
Snag	A standing dead tree usually greater than 5 feet in height and 6 inches in diameter at breast height. The interior of the snag may be sound or rotted. **Soft Snag:** A snag composed primarily of wood in advanced stages of decay and deterioration, generally not merchantable. **Hard Snag:** A snag composed primarily of sound wood, particularly sound sapwood; generally merchantable.
Soft Snag	See Snag
Soil Organic Matter	See Organic Matter.
Soil Productivity	The capacity of a soil to produce a specific crop such as fiber and forage, under defined levels of management. It is generally dependent on available soil moisture, nutrients, and length of growing season.
Soil Ravel	Movement of dry, noncohesive, surface soil material downslope under the influence of gravity.
Soil Resource Inventory (SRI)	A report containing soils information and associated data on geology, climate, vegetation, and landforms. The report is in the form of soil maps, mapping unit descriptions, tables displaying soil characteristics, and tables of soil management interpretations, useful to land managers as an aid to multiple use management.
Special habitat	Special and unique wildlife habitats are found throughout the Willamette National Forest. These habitats are generally natural forest openings, riparian areas, and meadows or geologic features such as cliffs, talus, riparian areas and caves.
Spotted Owl Habitat Area (SOHA)	A habitat area designated to support one pair of spotted owls.
Stand	A community of trees or other vegetative growth occupying a specific area and sufficiently uniform in composition (species), age, spatial arrangement, and conditions as to be distinguishable from the other growth on adjoining lands, so forming a silvicultural or management entity.

Stocking	The degree to which trees occupy the land, measured by basal area and/or number of trees by size and spacing, compared with a stocking standard; that is, the basal area and/or number of trees required to fully utilize the site's growth potential.
Stream Class	The classification of streams according to their beneficial uses. Whole streams or parts of streams can be classified. A stream may be divided into several classes. **Class I**: Perennial or intermittent streams have one or more of the following characteristics: (1) are the direct source of water for domestic use (cities, recreation sites, etc.); (2) are used by large numbers of fish for spawning, rearing, or migration; (3) contain enough flow to have a major influence on water quality of a Class I stream. **Class II**: Perennial or intermittent streams have one or both of the following characteristics: (1) Are used by moderate though significant numbers of fish for spawning, rearing, or migration; (2) Flow enough water to have a moderate influence on downstream quality of a Class I or II stream. **Class III**: All other perennial streams not meeting Class I or Class II definitions. **Class IV**: All other intermittent streams not meeting Class I, II, or III definitions.
Streamside Management Unit (SMU)	Areas of land along rivers and streams where management activities are modified to provide water and wildlife habitat which will meet present Forest Service policy standards.
Subdrainage	The smallest division of a watershed. A subdrainage can contain Class II, III, or Class IV streams.
Subwatershed	An administrative boundary of a watershed commonly containing a number of subdrainages.
Succession	The progressive development of vegetation toward its highest ecological expression, the climax community; replacement of one plant community by another.
Successional Stage	A phase in the gradual supplanting of one community of plants by another. A stage or recognizable conditions of a plant community that occurs during its development from bare ground to climax; for example, coniferous forests in the Cascade Mountains progress through six recognized stages: grass-forb, shrub-seedling, pole-sapling, young, mature, old-growth.
Suitability	The appropriateness of applying certain resource management practices to a particular area of land, as determined by an analysis of the economic and environmental consequences and the

	alternative uses foregone. A unit of land may be suitable and available for a variety of individual or combined management practices.
Suitable Forest Land (SFL)	Forest land for which technology is available that will ensure timber production without irreversible resource damage to soils, productivity, or watershed conditions; for which there is reasonable assurance that such lands can be adequately restocked and for which there is management direction that indicates that timber production is an appropriate use of that area.
Summer Range (SR)	An area that is potentially capable of supporting big game during the summer use period.
Suppression (Fire Suppression)	Any act taken to slow, stop, or extinguish a fire. Examples of suppression activities include fireline construction, back-firing, and application of water or chemical fire retardants.

T

Thermal Cover	Vegetative cover used by animals to modify the adverse effects of weather (adapted from Thomas 1979); a forest stand that is at least 40 feet in height with three canopy cover of at least 70 percent.
Tiering	The elimination of repetitive discussions in an environmental document by incorporating by reference the discussion of similar issues in an environmental impact statement of broader scope. For example, a project environmental assessment could be tiered to the Forest Plan EIS.
Threatened or Endangered Species (T&E)	Any species of plant or animal which is likely to become endangered within the foreseeable future throughout all or a significant portion of its range as designated by the USDI Fish and Wildlife Service.
Total Organic Material (TOM)	Green and decaying vegetation, litter, roots, and soil organic matter that are inputs into the soil nutrient cycling process.
Total Resource Inventory (TRI)	A multi-media information system using maps, photographs, paper forms, microfilm, and computer storage to handle very large volumes of environmental data for access and analysis. TRI is currently used on National Forests in the Pacific Northwest Region (Oregon and Washington) to provide storage and retrieval for all in-place resource data.

Tree Mortality Class	Refer to the definition for Fire Intensity descibing size (DBH) of trees killed by fire through destruction of the cambium layer.
Tuff	Deposits of volcanic ash. Sand-sized and smaller rock fragments blown out of a volcano.
Tuffaceous (rocks)	Having Tuff as a component.
Turbidity	The optical property of water as affected by suspension of material such as sediment, i.e., the muddy or cloudy state of water.

U

Understory	Vegetation (trees or shrubs) growing under the canopy formed by taller trees.
Unsuitable Timber Land	Lands not selected for timber production during the development of the Forest Plan due to: multiple-use objectives for the alternative precluding timber production; other management objectives for the alternative limit timber production activities to the point where management requirements cannot be met; and the fact that the lands are not cost-efficient to manage over the planning horizon in meeting forest objectives that include timber production. Land not appropriate for timber production are designated as unsuitable in the Forest Plan.

V

Viewshed	Sub-units of the landscape where the visitor's view is contained by topography similar to a watershed.
Visual Allocation	A land allocation designed to achieve specific scenic management objectives. See Visual quality objectives.
Visual Absorption Capacity (VAC)	The measure of the land's capability to absorb alterations, yet retain its visual integrity.
Visual Quality Objective (VQO)	A desired level of scenic quality and diversity of natural features based on physical and sociological characteristics of an area. Refers to the degree of acceptable alterations of the characteristic landscape. **Preservation**: In general, human activities are not detectable to the visitor.

Retention: Human activities are not evident to the casual forest visitor.

Partial Retention: Human activities may be evident but must remain subordinate to the characteristic landscape.

Modification: Human activity may dominate the characteristic landscape but must, at the same time, utilize naturally established form, color, and texture. It should appear as a natural occurrence when viewed as middleground or background.

Maximum Modification: Human activity may dominate the characteristic landscape but should appear as a natural occurrence when viewed as background.

Visual Resource	The composite of basic terrain, geologic features, water features, vegetative patterns, and land use effects that typify a land unit and influence the visual appeal the unit may have for visitors.
Volume	See Harvest Volumes.

W

Watershed	A portion of the forest in which all surface water drains to a common point. Watersheds can range from a few tens of acres that drain a single small intermittent stream to many thousands of acres for a stream that drains hundreds of connected intermittent and perennial streams.
Water Yield	The measured output of the Forest's streams.
Wetlands	Those areas that are inundated by surface or ground water with a frequency sufficient, under normal circumstances, to support a prevalence of vegetative or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction. Wetlands include marshes, bogs, sloughs, potholes, river overflows, mud flats, wet meadows, seeps, and springs.
Winter Range (WR)	The area available to and used by big game through the winter season.

X-Y-Z

Xylem	The principal strengthening and water-conducting tissue of the stems, roots, and leaves of vascular plants. It is characterized by the woody portion of the vascular tissue.

ACRONYMS AND ABBREVIATIONS

Acronyms and Abbreviations with an asterisk are defined in the Glossary

ARP	Aggregate Recovery Percentage *
ASQ	Allowable Sale Quantity *
BEMA	Bald Eagle Management Area *
BF	Board Foot *
BTU	British Thermal Unit
CE	Cumulative Effect *
CEQ	Council on Environmental Quality *
CFL	Commercial Forest Land *
CFS	Cubic Feet Per Second *
CSS	Cover Size and Spacing
CURRENT FOREST PLAN/FEIS	Willamette National Forest Multiple-Use Land Management Plan, 1977 *
CVI	Cover Value Index
CY/YR	Cubic Yards per Year
DBH	Diameter at Breast Height *
DEIS	Draft Environmental Impact Statement *
DO	Dissolved Oxygen *
EA	Environmental Assessment *
EIS	Environmental Impact Statement *
FEIS	Final Environmental Impact Statement
FORPLAN	Forest Planning *
FS	Forest Service

FTE	Full-time Equivalent *
FY	Fiscal Year
GIS	Geographic Information System *
HQI	Habitat Quality Index *
ICOs	Issues, Concerns, and Opportunities
ID Team	Interdisciplinary Team *
IHI	Interior Habitat Index *
IMPLAN	Impact Analysis for Planning *
JTU	Jackson Turbidity Unit *
K-V	Knutson-Vandenberg Act of l924 *
LRAPA	Lane Regional Air Pollution Authority
LWD	Large Woody Debris *
MBF	Thousand Board Feet
MMBF	Million Board Feet
MOM	Mature and Over Mature *
MR	Management Requirement *
NB	Net Benefits *
NEPA	National Environmental Policy Act *
NETWORK	Network Analysis *
NFMA	National Forest Management Act *
NTU	Nephlometric Turbidity Unit *
O&C	Oregon and California Land Grant *
ODEQ	Oregon Department of Environmental Quality
ODFW	Oregon Department of Fish and Wildlife
PAM	Per Acre Material
PM	Predicted Mortality *
PMHA	Pine Marten Habitat Area *

PNV	Present Net Value *
PPM	Parts per Million
PVC	Present Value Cost
PROPOSED FOREST PLAN/DEIS	Proposed Land and Resource Management Plan, WNF, 1987
PWHA	Pileated Woodpecker Habitat Area *
RD	Ranger District *
RDI	Road Density Index
RPC	Road Purchaser Credit *
SFL	Suitable Forest Land *
SHPO	State Historic Preservation Office
SMU	Streamside Management Unit *
SOHA	Spotted Owl Habitat Area *
SR	Summer Range *
SRI	Soil Resource Inventory *
SSI	Size and Spacing Index
T&E	Threatened and Endangered Species *
TOM	Total Organic Material *
TPA	Trees Per Acre
TRI	Total Resource Inventory *
TSSF	Timber Sale Salvage Fund
USGS	United States Geological Survey
VQO	Visual Quality Objective *
WNF	Willamette National Forest
WR	Winter Range *

A

Aggregate recovery percentage

S-2,
I-7,
II-13, II-15, II-17, II-22,
III-18,
IV-17, IV-22

Air quality

III-23, III-24,
IV-41, IV-42,
IV-112,
V-28

Alternative comparison by issue

S-7, S-8, S-9, S-10,
II-17, II-18, II-19, II-20

Alternative development

S-4,
II-1, II-2, II-3, II-4

Analysis area

S-1, S-2, S-3, S-4, S-5, S-6, S-7, S-11, S-13,
I-2, I-4, I-7, I-9,
II-4, II-12, II-17,
III-2, III-3, III-5, III-9, III-10, III-11, III-13, III-14, III-16, III-18, III-20, III-23,
III-25, III-26, III-27, III-28, III-29, III-30, III-31, III-32, III-33, III-34, III-35,
III-36, III-38, III-39, III-40, III-41, III-42, III-43, III-44, III-45, III-46, III-52
IV-1, IV-2, IV-4, IV-5,IV-14, IV-20, IV-21, IV-22, IV-26, IV-28, IV-30,
IV-31, IV-32, IV-34, IV-35, IV-37, IV-38, IV-44, IV-58, IV-65, IV-72, IV-73,
IV-74, IV-79, IV-82, IV-83, IV-87, IV-92, IV-98, IV-99, IV-100, IV-106,
IV-111, IV-113
V-10, V-23, V-35, V-39, V-41, V-44, V-46

Analysis process

S-1,
I-10,
II-1, II-2, II-3,
IV-106

Area reforested

S-8,
II-18

ARP

S-2, S-7, S-11,
I-7,
II-13, II-17, II-22,
III-18, III-19,
IV-17, IV-20, IV-22, IV-23, IV-28, IV-31, IV-32, IV-34, IV-35, IV-37, IV-38,
V-10, V-11

ASQ

V-42

Assumptions

II-4,
IV-16, IV-57, IV-102,
V-8, V-10, V-34, V-41

B

Bald eagle

S-4, S-5, S-9
I-4,
II-8, II-12, II-13, II-14, II-15, II-16, II-19,
III-35, III-38, III-39,
IV-72, IV-113
V-32, V-33, V-45, V-50

Bald eagle management area

S-5
III-38
II-12, II-13, II-16,
IV-72
V-33, V-50

BEMA

S-5, S-6,
II-8, II-12, II-13, II-16,
III-38,
IV-72,
V-33

Beneficial uses

S-11,
II-23,
III-11, III-13, III-14
V-15, V-16

Big-game

S-9, S-12
I-7,
II-8, II-12, II-13, II-16, II-19, II-27,
III-32, III-33, III-34,
IV-65, IV-66, IV-73, IV-74, IV-75, IV-76, IV-77, IV-80, IV-81, IV-83, IV-84, IV-85, IV-87, IV-88, IV-103
V-30, V-35, V-41

Big-game habitat

I-7,
III-32, III-34,
IV-65, IV-66, IV-73, IV-74, IV-75, IV-77, IV-80, IV-81, IV-83, IV-85, IV-87, IV-88
V-35

Bird habitat

IV-69, IV-77, IV-82, IV-85, IV-88

Bull Creek

S-6
II-8, II-11, II-12, II-14, II-15, II-16, II-29,
III-15, III-32, III-35, III-38, III-39
IV-72, IV-89, IV-92, IV-96, IV-97
V-30, V-31, V-34, V-35, V-50, V-51

C

Campground

S-3, S-4
I-8
III-41, III-42, III-45
IV-91, IV-92, IV-93, IV-97, IV-98
V-41

Comparison of alternatives

S-1, S-7
I-9
II-1, II-17
V-8
V-39

County revenues

S-10
II-5, II-20
V-42

Cultural resource

II-6,
III-40,
IV-90,
IV-112

Cumulative effect

I-1, I-9
II-5, II-6
III-16, III-18
IV-1, IV-2, IV-30, IV-111
V-10, V-46

Current Forest Plan/FEIS

S-6
I-2, I-3, I-6,
II-13, II-14, II-15,
III-43,
IV-108
V-13, V-44, V-46

D

Dead and defective tree habitat

S-9,
II-19, II-29,
III-35, III-37
IV-68, IV-69, IV-75, IV-78, IV-82, IV-86, IV-89

Deer

S-4,
I-4,
III-32, III-33, III-34, III-41,
IV-65, IV-74, IV-77, IV-80, IV-84, IV-112

Deterioration

S-5,
I-3,
III-27,
IV-44, IV-70, IV-102, IV-103, IV-104,
V-23

Developed recreation

S-4,
III-41,
IV-91

Disease

IV-15, IV-44
V-48

Dispersed recreation

III-41,
IV-91, IV-92, IV-93

Diversity

III-25, III-26, III-32,
IV-6, IV-16, IV-43, IV-46, IV-47, IV-68, IV-69, IV-72,
V-23, V-30

E

Economic and social impacts

I-8,
II-5, II-31,
IV-102

Economic efficiency

S-10, S-13,
I-8,
II-5, II-20, II-30,
IV-102

Elk

S-4
I-4,
III-32, III-33, III-34, III-41,
IV-65, IV-66, IV-74, IV-77, IV-80, IV-84, IV-112
V-35

Energy

III-46,
IV-101, IV-113

Erosion

S-2, S-3, S-7, S-11,
I-3, I-6, I-7,
II-4, II-5, II-6, II-7, II-14, II-15, II-17, II-21, II-22, II-23
III-3, III-5, III-7, III-9, III-10, III-14, III-17, III-18, III-19, III-20
IV-3, IV-4, IV-5, IV-6, IV-7, IV-8, IV-9, IV-10, IV-11, IV-12, IV-13, IV-14,
IV-18, IV-19, IV-21, IV-23, IV-24, IV-26, IV-28, IV-29, IV-30, IV-32, IV-33,
IV-35, IV-36, IV-38, IV-39, IV-60, IV-63, IV-111
V-6, V-7, V-8, V-10, V-11, V-15, V-16, V-25, V-34, V-45

Erosion control

II-7,
V-11, V-45

Erosion index

S-2, S-7, S-11,
I-7,
II-17, II-22, II-23,
IV-23, IV-28, IV-29, IV-32, IV-33, IV-35, IV-36, IV-38, IV-39

F

Fertilization

III-53,
V-7

Fish

S-2, S-3, S-4, S-7, S-11
I-3, I-4, I-6, I-7
II-1, II-2, II-4, II-5, II-7, II-12, II-13, II-14, II-15, II-17, II-22, II-23,
III-10, III-12, III-18, III-19, III-20, III-21, III-31, III-37, III-40, III-41,
IV-14, IV-15, IV-16, IV-17, IV-19, IV-20, IV-23, IV-25, IV-29, IV-30, IV-33,
IV-36, IV-39, IV-66, IV-91, IV-92, IV-98, IV-111, IV-112,
V-1, V-3, V-7, V-10, V-11, V-12, V-13, V-14, V-15, V-16, V-17, V-18,
V-30, V-32, V-34, V-36, V-40, V-41, V-44, V-47, V-48

Fish habitat

S-2, S-7, S-11,
I-3, I-7,
II-1, II-4, II-13, II-14, II-15, II-17, II-22,
III-11, III-19, III-21, III-22,
IV-14, IV-15, IV-16, IV-20, IV-23, IV-25,
V-3, V-7, V-11, V-14, V-18

Fishing

S-4,
I-4,
III-21, III-41, III-42,
IV-91, IV-92,
V-15, V-40, V-41

Floodplain

IV-113,
V-12

Forage

S-9, S-12,
I-3, I-7,
II-8, II-12, II-13, II-16, II-19, II-27,
III-32, III-33, III-34,
IV-65, IV-66, IV-69, IV-73, IV-74, IV-75, IV-76, IV-77, IV-80, IV-81, IV-83,
IV-84, IV-87, IV-88, IV-91
V-14, V-30, V-41

Forage/hiding/thermal cover

S-9,
II-19,
III-33,
IV-74, IV-75, IV-80, IV-83, IV-87

Fuel loading

III-23, III-29, III-30
IV-4, IV-57, IV-58, IV-59, IV-60, IV-62, IV-64,
V-7, V-23

G

Geographic Information System

II-3

Geology

III-3,
IV-3,
V-6, V-8

Geothermal

III-46,
IV-100

Gross merchantable volume

II-4, II-13, II-14, II-15,
IV-48, IV-49, IV-50, IV-52, IV-54, IV-109,
V-46

Gross receipts

III-52

H

Habitat quality index

S-9,
I-7,
II-19, II-27,
III-34,
IV-66, IV-74, IV-77, IV-81, IV-85, IV-88

Harvest rate

S-10, S-13,
I-8,
II-20, II-29,
IV-95

Harvest systems

IV-49, IV-51, IV-53, IV-55

Hiding cover

S-12,
II-8, II-27
III-33,
IV-66, IV-74, IV-83, IV-84, IV-87

Hiking

III-41, III-42,
IV-91

Hills Creek

S-2, S-3, S-4, S-11, S-13,
I-2, I-4,
II-5, II-8, II-12, II-23, II-28,
III-3, III-11, III-13, III-14, III-15, III-16, III-17, III-19, III-20, III-21, III-22, III-32, III-33, III-35, III-38, III-39, III-40, III-41, III-42, III-43, III-45, III-46, III-54,
IV-2, IV-14, IV-15, IV-16, IV-17, IV-18, IV-20, IV-22, IV-23, IV-24, IV-25, IV-26, IV-29, IV-30, IV-32, IV-33, IV-35, IV-39, IV-69, IV-72, IV-73, IV-76, IV-78, IV-81, IV-82, IV-84, IV-85, IV-87, IV-89, IV-91, IV-92 IV-95, IV-96, IV-100
V-8, V-12, V-14, V-15, V-20, V-35, V-41

Hills Creek Reservoir

S-2, S-3, S-11,
I-4,
II-12,
III-11, III-13, III-14, III-19, III-20, III-21, III-32, III-40, III-41, III-43, III-46, III-54,
IV-2, IV-15, IV-17, IV-20, IV-23, IV-24, IV-29, IV-32, IV-35, IV-69, IV-91, IV-92, IV-95, IV-96, IV-100
V-8, V-14, V-15, V-20, V-35, V-41

HQI

S-9,
I-7,
II-19, II-27,
III-34,
IV-66, IV-73, IV-74, IV-75, IV-76, IV-77, IV-80, IV-81, IV-83, IV-84, IV-85, IV-87, IV-88

I

IHI

S-9,
II-19, II-27,
III-36,
IV-67, IV-68, IV-75, IV-77, IV-85, IV-89

Implementation

S-11, S-13,
II-23, II-28,
IV-3, IV-26, IV-28, IV-29, IV-30, IV-33, IV-34, IV-36, IV-37, IV-39, IV-98,
IV-99, IV-111,
V-11, V-12, V-17, V-28, V-34, V-36, V-45, V-46

Incidental green

S-5, S-6,
II-4, II-13, II-14, II-15,
IV-9, IV-11, IV-13, IV-96,
V-8, V-24

Insects

I-3,
III-27,
IV-15,
IV-44, IV-46, IV-47, IV-69,
V-23, V-48

Interdisciplinary team

II-1, II-2,
V-3, V-35, V-44

Interior forest species habitat

III-36
IV-67, IV-75, IV-77, IV-82, IV-85, IV-88, IV-89

Interior habitat index

S-9,
I-8,
II-19, II-27,
III-36,
IV-67

Issues

S-1, S-2, S-4, S-5, S-7,
I-6, I-9,
II-1, II-2, II-3,
IV-2,
V-1, V-2, V-3, V-16, V-46, V-50

J

Jobs

S-10, S-13, S-14,
I-8,
II-5, II-20, II-30, II-31,
III-49, III-50,
IV-102, IV-105, IV-106, IV-107, IV-108, IV-109, IV-110,
V-41, V-42

K

Key Indicators

S-7,
I-6, I-7, I-8,
II-2, II-3,
IV-10, IV-11, IV-12

L

Land allocation

S-6, S-10,
I-2,
II-20,
III-43,
IV-72,
IV-95,
IV-103, IV-107, IV-108,
V-44

Landslides

I-6,
III-3, III-9,
IV-8, IV-18, IV-23, IV-98, IV-111,
V-7, V-10

Lane County

S-3,
I-4,
II-8,
III-49, III-50, III-51, III-52,
IV-105,
V-2, V-3, V-38, V-42

Large woody debris

S-2, S-7,
I-7,
II-7, II-9, II-14, II-15, II-17,
III-13, III-14,
IV-7, IV-14, IV-16, IV-20, IV-21, IV-25, IV-29, IV-33, IV-36, IV-39, IV-68,
V-10, V-11, V-12, V-13, V-14, V-15, V-17, V-18, V-45

Large woody material

III-36,
IV-3, IV-6, IV-111,
V-13, V-36

Logging system

II-13, II-15,
IV-95, IV-96, IV-97, IV-104,
V-7, V-42, V-43

LWD

S-2, S-7,
I-7,
II-9, II-17,
IV-16, IV-20, IV-25, IV-26, IV-29, IV-30, IV-33, IV-34, IV-36, IV-37, IV-39,
IV-40, IV-68,
V-10, V-12, V-15

M

Management Requirements

II-16

Mass wasting

S-4, S-7,
I-6,
II-7, II-9, II-15, II-17,
III-3, III-8, III-9,
IV-3, IV-5, IV-6, IV-8, IV-9, IV-10, IV-11, IV-12, IV-13, IV-98, IV-99,
IV-111,
V-7, V-8, V-11

Minerals

III-46,
IV-98, IV-101

Mitigation

S-7, S-11, S-13,
I-9,
II-4, II-5, II-6, II-7, II-8, II-9, II-10, II-11, II-15, II-17, II-22, II-23, II-30,
III-54,
IV-26, IV-30, IV-50, IV-52, IV-54, IV-56, IV-86, IV-90, IV-91, IV-102,
IV-105, IV-111,
V-7, V-8, V-10, V-11, V-12, V-13, V-14, V-15, V-16, V-17, V-18, V-20,
V-21, V-30, V-32, V-33, V-34, V-35, V-36, V-38, V-40, V-41 V-45

Monitoring

II-11, II-12,
IV-23,
IV-102, IV-105,
V-2, V-15, V-16, V-17, V-20, V-25, V-30, V-31, V-32, V-33, V-34, V-40,
V-45, V-51,

N

Net benefits

S-10, S-13,
I-8,
II-5, II-20, II-30,
IV-102, IV-105, IV-107

Northern spotted owl

S-9,
I-4, I-8,
II-10, II-11, II-19, II-29,
III-32, III-35, III-36, III-39,
IV-67, IV-75, IV-79, IV-83, IV-86, IV-89

O

ODFW

II-2,
III-21,
V-30

Old-growth

S-3, S-4, S-6, S-9, S-13,
I-2, I-4, I-7, I-8,
II-4, II-19, II-29,
III-26, III-35, III-39, III-43,
IV-43, IV-47, IV-49, IV-51, IV-53, IV-55, IV-65, IV-66, IV-67, IV-68, IV-75,
IV-77, IV-82, IV-85, IV-88, IV-92, IV-112,
V-20, V-24, V-35, V-36, V-46, V-51

Old-growth dependent species

S-6, S-9, S-13,
II-19, II-29,
V-35

Old-growth habitat

III-35,
IV-67, IV-75, IV-77, IV-82, IV-85, IV-88,
V-36, V-46, V-51

Oregon Department of Fish and Wildlife

II-2, II-12,
III-21, III-42,
IV-66,
V-1, V-30, V-36, V-44

Organic matter

II-7,
III-6, III-7, III-9, III-10,
IV-11,
V-6

P

Partial cut

S-8, S-12
II-10, II-12, II-18, II-23, II-27
IV-48, IV-49, IV-50, IV-51, IV-52, IV-53, IV-54, IV-55, IV-60, IV-61, IV-62,
IV-63, IV-83, IV-84, IV-93, IV-97,
V-24, V-32, V-36

Partial retention

S-10,
II-20, II-29,
III-43, III-44,
IV-95, IV-97, IV-109, IV-110

Pileated woodpecker

S-6, S-9,
I-4, I-8,
II-13, II-19,
III-35,
IV-67, IV-71, IV-75, IV-82, IV-85, IV-88,
V-50

Pileated woodpecker habitat area

S-6,
I-4,
II-13,
III-35,
IV-88

Pine marten

S-6, S-9,
I-8,
II-13, II-19,
III-35,
IV-67, IV-75, IV-77, IV-82, IV-85, IV-88,
V-35

Pine marten habitat area

S-6,
III-35,
IV-88,
V-35

Plant habitat

IV-50, IV-67

PMHA

S-6,
II-13, II-14, II-15, II-16,
III-35

PNV

S-13,
I-8,
II-30,
IV-102, IV-103, IV-105, IV-107, IV-108, IV-109, IV-110

Present net value

S-3, S-10,
I-8,
II-5, II-20,
IV-102, IV-105

Primary cavity excavator

S-9, S-13,
I-8,
II-10, II-11, II-19, II-28, II-29,
III-37,
IV-68, IV-75, IV-78

Proposed Forest Plan/DEIS

S-5, S-6,
I-2, I-6,
II-14, II-15, II-16,
III-19, III-20, III-32, III-38, III-39, III-43, III-44,
IV-2, IV-49, IV-51, IV-95, IV-102, IV-109, IV-110,
V-8, V-10, V-13, V-25, V-35, V-39, V-42, V-44

Public involvement

I-6,
V-1

Public issues

V-50

R

Recreation

S-3, S-4, S-10, S-13
I-4, I-6, I-8,
II-1, II-8, II-20, II-29,
III-11, III-33, III-41, III-42, III-43, III-45, III-48, III-50, III-51,
IV-41, IV-67, IV-90, IV-91, IV-92, IV-93, IV-96, IV-98, IV-103, IV-112,
V-35, V-38, V-39, V-40, V-41, V-48

Reforestation

S-3, S-5, S-12,
I-3, I-4, I-7,
II-6, II-12, II-23,
III-27,
IV-4, IV-8, IV-43, IV-44, IV-47, IV-48, IV-58,
V-12, V-13, V-20, V-23, V-24, V-33, V-39, V-40, V-42, V-43, V-48

Regeneration harvest

S-5, S-11,
II-4, II-6, II-21,
IV-48, IV-49, IV-50, IV-51, IV-52, IV-53, IV-54, IV-55,
IV-76, IV-79, IV-80, IV-82, IV-88,
V-33

Rehabilitation

S-5,
II-5, II-12,
III-10, III-54,
IV-8, IV-46, IV-73, IV-105, IV-107,
V-39, V-40

Retention

S-10, S-13,
II-20, II-29,
III-5, III-16, III-43, III-44,
IV-47, IV-52, IV-54, IV-56, IV-58, IV-63, IV-95, IV-97, IV-109, IV-110,
IV-111,
V-12, V-13, V-14, V-15, V-20, V-23, V-25, V-33, V-34, V-35, V-45, V-47,
V-50

Riparian

S-6, S-9, S-11, S-12, S-13,
I-3, I-8,
II-5, II-6, II-9, II-13, II-14, II-15, II-19, II-22, II-27, II-29,
III-10, III-13, III-14, III-16, III-21, III-22, III-25, III-32, III-38,
IV-4, IV-16, IV-17, IV-25, IV-65, IV-69, IV-72, IV-75, IV-79, IV-82, IV-86,
IV-89,
V-2, V-10, V-12, V-13, V-14, V-15, V-17, V-25, V-35, V-45

Riparian-dependent species

III-38,
IV-69, IV-72, IV-75, IV-79, IV-82, IV-86, IV-89

Road construction

S-6, S-8, S-11, S-12, S-14,
II-6, II-8, II-14, II-18, II-21, II-25, II-26, II-31,
III-14,
IV-4, IV-5, IV-9, IV-11, IV-32, IV-90, IV-95, IV-100, IV-104, IV-105,
IV-106, IV-109, IV-111,
V-7, V-8, V-18, V-21, V-43

S

Safety

S-5
II-8, II-10, II-12, II-14,
IV-92,
V-38

Scenic quality

S-3, S-4,
I-3, I-4,
II-13,
III-43,
IV-1, IV-91

Scenic resource

S-3,
III-43,
IV-96

Scoping

S-2,
I-6,
II-1, II-2, II-3,
V-46

Sediment

S-2, S-3, S-7, S-11,
I-7,
II-7, II-8, II-12, II-15, II-17, II-22, II-23,
III-11, III-13, III-14, III-17, III-19, III-20, III-21, III-22, III-38,
IV-3, IV-5, IV-6, IV-14, IV-15, IV-18, IV-19, IV-20, IV-21, IV-23, IV-24,
IV-25, IV-26, IV-28, IV-29, IV-30, IV-32, IV-35, IV-37, IV-38, IV-65, IV-69,
IV-98, IV-111, IV-112,
V-7, V-8, V-10, V-14, V-15, V-16, V-18,

Sensitive plant effects

IV-47, IV-50, IV-51, IV-53, IV-55

SFL

III-39
IV-68, IV-72
V-32

Shady Beach fire

S-1, S-2
I-1, I-2, I-4, I-10,
II-12,
III-2, III-11, III-13, III-19, III-24, III-25, III-29, III-30, III-35, III-36, III-39,
III-43, III-44,
IV-2, IV-3, IV-42, IV-46, IV-57, IV-59, IV-65, IV-90, IV-102, IV-106,
V-1, V-4, V-6, V-7, V-8, V-10, V-16, V-25, V-30, V-31, V-42, V-45, V-48,
V-50

SMU

II-9, II-10, II-11, II-13, II-15,
IV-11, IV-69,
V-12, V-33,

Snag

II-10, II-11, II-12,
III-26, III-30, III-35, III-37, III-39, III-44,
IV-58, IV-59, IV-61, IV-62, IV-63, IV-64, IV-65, IV-68, IV-69, IV-70, IV-71,
IV-75, IV-78, IV-79, IV-82, IV-83, IV-86, IV-89, IV-96, IV-97,
V-13, V-31, V-32, V-33, V-34, V-36, V-39

SOHA

S-6,
II-13, II-14, II-15, II-16, II-29,
III-35, III-38, III-39,
IV-72, IV-89, IV-97,
V-30, V-31, V-34, V-35, V-40, V-50, V-51

Soil

S-2, S-3, S-4, S-6, S-7, S-11,
I-4, I-6, I-7,
II-1, II-2, II-4, II-5, II-6, II-7, II-12, II-13, II-15, II-17, II-21, II-22,
III-2, III-3, III-5, III-6, III-7, III-9, III-10, III-13, III-14, III-18, III-20,
III-25, III-27, III-40,
IV-3, IV-4, IV-5, IV-6, IV-7, IV-8, IV-9, IV-10, IV-11, IV-12, IV-13, IV-18,
IV-23, IV-44, IV-50, IV-51, IV-52, IV-53, IV-54, IV-55, IV-56, IV-58, IV-60,
IV-62, IV-95, IV-96, IV-99, IV-110, IV-111, IV-112,
V-6, V-7, V-8, V-10, V-11, V-15, V-16, V-25, V-36, V-47

Soil productivity

S-11,
II-6, II-21,
III-5, III-7,
IV-3, IV-6, IV-8, IV-9, IV-10, IV-12, IV-13, IV-58,
V-6

Spotted owl

S-6, S-9, S-13,
I-4, I-8,
II-10, II-11, II-13, II-16, II-19, II-29,
III-32, III-35, III-36, III-38, III-39,
IV-67, IV-72, IV-75, IV-79, IV-83, IV-86, IV-89, IV-97,
V-31, V-34, V-35, V-40, V-50

Spotted owl habitat area

S-6
III-35,
IV-97,
V-31, V-34

Standards and guidelines

S-5, S-6, S-13,
I-2, I-7,
II-14, II-15, II-29,
III-44,
IV-2, IV-95,
V-10, V-34, V-44

Streamside management unit

II-13, II-14,
IV-8, IV-69,
V-12

Suitability

I-4,
II-11,
III-38, III-39,
IV-86, IV-89

Surface-soil erosion

I-6,
II-4,
III-7, III-9,
IV-3, IV-4, IV-5, IV-6, IV-8, IV-9, IV-10, IV-11, IV-12, IV-13, IV-23

T

Temperature

S-2, S-3, S-7, S-11,
I-7, I-8,
II-4, II-5, II-7, II-12, II-17, II-22, II-23,
III-11, III-14, III-15, III-16, III-18, III-21, III-22, III-27, III-30, III-32,
IV-14, IV-15, IV-17, IV-19, IV-20, IV-21, IV-22, IV-25, IV-26, IV-27, IV-29,
IV-30, IV-31, IV-33, IV-34, IV-36, IV-37, IV-39, IV-43, IV-44, IV-65, IV-69,
IV-72,
V-6, V-10, V-13, V-14, V-15, V-16, V-17

Thermal cover

S-9, S-12,
II-8, II-13, II-16, II-19, II-27,
III-32, III-33, III-34,
IV-65, IV-66, IV-74, IV-75, IV-77, IV-80, IV-83, IV-87, IV-88, IV-112,
V-30

Threatened, endangered, and sensitive plants

III-28

Threatened, endangered, and sensitive species

S-12, S-13,
I-8
II-27,
III-35,
IV-52, IV-54, IV-56, IV-72, IV-75, IV-77, IV-79, IV-82, IV-83, IV-85, IV-86,
IV-88, IV-89,
V-32, V-33, V-50,

TOM

I-6,
II-21,
III-5, III-6, III-25, III-40
IV-3, IV-4, IV-6, IV-7, IV-8, IV-10, IV-11, IV-12, IV-15
V-6, V-42

Total organic material

S-7, S-11,
II-17, II-21,
III-6,
IV-3, IV-4, IV-6, IV-7, IV-8, IV-9, IV-10, IV-11, IV-12, IV-13,
V-6, V-7

Trout

S-3,
I-4,
III-11, III-20, III-21, III-22,
IV-15, IV-16,
IV-65,
V-14

Turbidity

S-2, S-3, S-7, S-11,
I-7,
II-7, II-12, II-17, II-22, II-23,
III-11, III-14, III-19, III-20,
IV-14, IV-15, IV-18, IV-19, IV-21, IV-23, IV-24, IV-25, IV-28, IV-29, IV-30,
IV-32, IV-35, IV-37, IV-38,
V-7, V-10, V-15, V-16, V-18

U

Unsuitable timber lands

II-24,
IV-12, IV-48, IV-50, IV-52, IV-54,
V-6, V-33

V

Viable population

IV-64, IV-73, IV-74, IV-76, IV-77, IV-81, IV-84, IV-85, IV-87, IV-88,
V-31, V-34, V-35

Viewshed

S-3,
I-2,
II-14,
III-43,
IV-95

Visual quality objective

S-10, S-13,
II-20,
III-43, III-44,
IV-95,
V-20, V-39

Volume growth loss

S-8, S-12,
I-7,
II-18, II-25,
IV-47

Volume harvested

S-8,
I-7,
II-4, II-18, II-23,
V-46, V-51

Volume loss

III-27,
IV-47, IV-49, IV-51, IV-53, IV-55, IV-102, IV-103, IV-104

VQO

S-10,
II-20,
III-43, III-44
IV-95,
V-39

W

Wage Income

S-10, S-13,
I-8,
II-5, II-20, II-30,
III-49,
IV-102, IV-107, IV-108, IV-109, IV-110,
V-41, V-42

Water quality

S-2, S-3, S-4, S-5, S-7, S-11,
I-3, I-4, I-6, I-7, I-10,
II-1, II-4, II-6, II-9, II-13, II-14, II-15, II-17, II-22,
III-11, III-13, III-14, III-21,
IV-2, IV-14, IV-16, IV-26, IV-34, IV-69, IV-102, IV-112,
V-3, V-11, V-12, V-13, V-15, V-16, V-17, V-18, V-24, V-25, V-32, V-40,
V-47, V-48

Water temperature

S-3, S-7, S-11,
I-7,
II-17, II-23,
III-11, III-14, III-15, III-16, III-21, III-22,
IV-15, IV-17, IV-20, IV-26, IV-29, IV-33, IV-36, IV-39, IV-65, IV-69, IV-72,
V-14, V-17

Wildfire

II-6,
III-9, III-21, III-29, III-30,
IV-1, IV-3, IV-4, IV-17, IV-41, IV-42, IV-43, IV-57, IV-58, IV-59, IV-60,
IV-61, IV-62, IV-64, IV-112,
V-6, V-8, V-23, V-35, V-38

Wildlife habitat

S-3, S-4, S-5, S-6, S-9, S-12,
I-4, I-7,
II-1, II-2, II-10, II-11, II-12, II-13, II-14, II-15,
II-16, II-19, II-27,
IV-2, IV-60, IV-61, IV-62, IV-63, IV-65, IV-73, IV-97, IV-102, IV-109,
IV-110, IV-112,
V-6, V-30, V-33, V-35, V-47, V-48, V-50

Winter range

S-4, S-12,
II-27,
III-32, III-33, III-34,
IV-65, IV-73, IV-76, IV-80, IV-81, IV-83, IV-84, IV-87,
V-30, V-36